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ABSTRACT

Ten lessons on the evolution of the nuclear arms race, the nature and consequences of using nuclear weapons, and new ways that conflicts among nations might be resolved are presented for the junior high school level. The unit contains age-appropriate materials to equip students with skills and knowledge to understand what choices can be made to ensure a peaceful and secure future. Also, conflict is addressed on a personal level so that students can analyze their own behavior and understand the importance of communicating, negotiating, and dealing with aggression through nonviolent means. Specific topics covered are the effects of the first atomic bomb; conflict on a personal level; communication, negotiation, and compromise; nuclear war; the arms race; escalation; relations between the United States and the Soviet Union; reducing risks of nuclear war; the development of one's own opinions; and the use of imagination in considering alternative futures. For the final lesson students embark on a group or class project that will allow them to act on their own knowledge and feelings. Students are involved in simulation and role play, and in doing case studies, and worksheets. Each lesson lists goals, activities, and materials required. Reproducible student worksheets and quizzes are also provided. Appendices contain a list of resource materials, fact sheets and background information, teacher and student glossaries, and forms for teacher and student evaluations. (KC)

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Choices:

a unit on conflict and nuclear war

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FOREWORD

Young, and even very young, children are telling their parents and teachers that they are afraid of dying in a nuclear war. In the past, we have been poorly informed and ill equipped to respond to these fears and have offered little to young people outside of unconvincing reassurances. This history of silence and ignorance in too many American classrooms is now being overcome, as pioneering curricula on the subject of nuclear war are being introduced in high schools and junior high schools throughout the country.

Recent studies demonstrate that the nuclear arms race and the experience of living with the threat of imminent annihilation have had a significantly adverse impact on the emotional lives of young people in the United States and other countries. Ignorance on the part of teenagers, their parents, and their teachers about the nature and effects of nuclear weapons has left adolescents helpless in the face of the psychological impact of the formidable and destructive threat these weapons pose.

Indeed, adolescents admit they are frightened by nuclear weapons and the nuclear arms race. They are grateful, however, for information they receive on these subjects that is presented in a meaningful and objective manner. They become better equipped, they say, to handle their fears, to take a responsible part in the growing national dialogue about nuclear weapons, and to participate in the worldwide effort now underway to prevent their use.

It is a major effort to tell adolescents the truth about instruments of mass destruction. This educational unit provides a sound body of information on the evolution of the nuclear arms race, the nature and consequences of using nuclear weapons, and the new ways that conflicts among nations must be resolved if life on the planet is to survive. By teaching this unit, educators can show young people that adults care about their future and are willing to join with them in preserving the continuity of human life. Educators can and should be models of responsible adults who are willing to confront the realities of the nuclear threat and to act to secure the future.

Although much of what is contained in this unit is difficult and often unpleasant to contemplate, the imaginative and innovative exercises will help young minds visualize and experience the nuclear reality in a way that is not threatening. American teenagers will then have gained knowledge of our most compelling and dangerous reality. Having grasped these truths, this generation of American teenagers may then be the one that will act to set us free from the nuclear menace that is endangering the future of our world.

John E. Mack, M.D.
Professor of Psychiatry
Harvard Medical School
at The Cambridge Hospital

Dr. Mack is the author of several articles on the psychological impact of the threat of nuclear war, including: Beardslee, William, and Mack, John E. "The Impact on Children and Adolescents of Nuclear Developments." Task Force Report #20: *Psychosocial Aspects of Human Development*. Washington, D.C.: American Psychiatric Association, Spring 1982.

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The Union of Concerned Scientists wishes to express its appreciation to the Massachusetts Teachers Association and the National Education Association for their assistance with *Choices: A Unit on Conflict and Nuclear War*. From the beginning of the project, these two organizations have provided the expertise we required to make the material truly useful for teachers and their students.

The National Education Association is the nation's largest teacher organization. Its 1.7 million members teach in elementary, junior and senior high schools, and colleges and universities in every state and territory. The Massachusetts Teachers Association is an affiliate of the NEA. MTA represents more than 50,000 Massachusetts educators. Both organizations have a strong commitment to improving the quality of public education.

The Union of Concerned Scientists is a nationwide organization of scientists and citizens concerned about the impact of advanced technology on society. UCS conducts research, public education, and advocacy in three areas of public interest: nuclear arms control, nuclear power safety, and national energy policy.

Coordination of this project was provided by a steering committee composed of:

Robert McClure, Program Manager, NEA Instruction and Professional Development
Carol Doherty, President, MTA
Howard Ris, Director, Nuclear Arms Program, UCS.

A team of teachers and curriculum specialists was assembled to write the instructional unit. Their unbounded enthusiasm and energy are responsible for the wealth of imaginative and informative material included herein:

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Natalie Goldring, UCS
Barbara Kinach, NEA/MTA
Constance Phillips, NEA/MTA
Jerry Spindel, NEA/MTA
R. Bruce Ward, NEA/MTA.

This unit was field-tested by 47 teachers in 34 states who were selected by the presidents of their state education associations. These pilot teachers met in Detroit in October 1982, where the writing team trained them to teach the unit and to collect data for the revision. The group met again in Memphis in December to report the results of their work. The pilot teachers exhibited an extraordinary commitment and dedication to this project. The sponsors and the writing team gratefully acknowledge their meticulous attention to making this material appropriate for junior high school students and their willingness to be hardnosed critics:

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Karen Rectanus, North Carolina Association of Educators
David Roeber, South Dakota Education Association
Wesley Scouten, Maryland State Teachers Association, Inc.
Ron Thomas, Tennessee Education Association

I am pleased that UCS is able to make this instructional material available to America's teachers.

Henry W. Kendall
Chairman
Union of Concerned Scientists

Teacher's Guide

INTRODUCTION AND RATIONALE

> There is no issue more important than the avoidance of nuclear war. It is incredible for any thinking person not to be concerned with the issue. No species is guaranteed tenured life on this planet. We are privileged to be alive and to think. We have the privilege to affect the future.
>
> Carl Sagan, astronomer and host of the popular television program, "Cosmos"
> November 11, 1981

Most students in junior high school have little, if any, understanding of nuclear weapons and nuclear war. Yet they are now confronted with a burgeoning national debate on, and widespread media attention to, the threat of nuclear war. Unless they are given the knowledge and skills to understand this debate and why the concern over nuclear war has become so urgent, their response is likely to be one of fear and despair.

In response to that need, the Union of Concerned Scientists (UCS), with assistance from the Massachusetts Teachers Association (MTA) and the National Education Association (NEA), developed this junior high school instructional unit. It is designed to help students understand the power of nuclear weapons, the consequences of their use, and most importantly, the options available to resolve conflicts among nations by means other than nuclear war.

The unit is not intended to advance specific political positions. Rather, it contains age-appropriate materials that will help equip students with the skills and knowledge to understand what choices can be made to ensure a peaceful and secure future for the United States and the world.

SYNOPSIS AND STRUCTURE OF THE UNIT

This unit raises fundamental questions about conflict, war, and nuclear weapons. It is designed to highlight both historical decisions on nuclear weapons and the choices available when considering the future roles of those weapons. It is important to tell students that these subjects are complex, and that you are not necessarily an expert on conflict or nuclear war. It is also important for you to admit your fears about nuclear war. This may help students more freely admit their own fears.

This unit addresses conflict on a personal level so that students can analyze their own behavior and understand the importance of communicating, negotiating, and dealing with aggression through nonviolent means. Personal conflict is not merely small-scale conflict; rather, it illustrates problems that may exist among nations. For example, studying the consequences of a fight between two teenagers may help introduce concepts such as escalation, negotiation, and resolution. The unit encourages students to understand that violent resolution of disputes does not always lead to desired results.

Even those who are considered "experts" on nuclear war admit there is still a great deal of uncertainty about the uses and effects of nuclear weapons. The teacher's role is to help students comprehend the complexity of nuclear war and the related issues they will have to deal with as adults.

THE LESSONS

The unit can be taught in a period ranging from two to four weeks. It is possible to introduce the core concepts in as few as 10 class periods (2 weeks). To do this, use only those activities marked with a star. For the full four-week unit, use all activities. Additional activities marked "optional" are included as potential substitutes or supplemental activities.

Lesson 1 introduces students to the effects of the first atomic bomb. Students examine the reasons for studying nuclear war and see that their participation with others can help prevent nuclear war.

Lesson 2 begins with an explanation of conflict. Before studying war—the most extreme form of conflict—students examine conflict on a personal level. Both sources and means of resolving conflict are explored.

Lesson 3 builds on the understanding of conflict gained in the previous lesson. Communication, negotiation, and compromise are introduced as means of resolving personal and group conflict. Games help illustrate the complexity of conflict resolution.

Lesson 4 takes conflict to its worst end point—nuclear war. Students study the weapons of history and recognize that nuclear warfare represents a leap beyond previous weaponry. The chemical and biological effects of nuclear weapons are introduced.

Lesson 5 deals with the arms race, escalation, and the economic consequences of building nuclear weapons. A quiz on Lessons 1 through 5 is included.

Lesson 6 elicits students' feelings about Soviet-U.S. relations, while also examining national foreign policy goals. An exercise on federal budget priorities is included.

Lesson 7 examines ways of reducing the risk of nuclear war among the superpowers. Several future national security options are discussed.

Lesson 8 encourages students to develop their own opinions apart from the many influences in their lives.

Lesson 9 emphasizes the use of imagination in considering alternative futures.

A potential outcome of studying nuclear war is a sense of hopelessness and despair. To counter this, the primary purpose of *Lesson 10* is to help students translate their knowledge into action. Several class projects are suggested. It is very important for teachers and students to develop the conviction needed to combat hopelessness and work toward ensuring our survival.

> If nuclear war should occur, it will come about not because it was inevitable, but because not enough [people] took the trouble to avert it.[1]

---

[1] Cousins, Norman. *Human Options.* New York: Norton, 1981, p. 73.

LESSON FORMAT

The lesson capsule summarizes the goals and activities for each day. Where appropriate, background material for the teacher is cited or provided. The list of purposes includes cognitive knowledge we wish students to gain as well as attitudes and concepts students will explore. A list of materials needed for each activity is also included. The lesson description is a step-by-step list of activities; we recommend that you read this before teaching the class so that, if necessary, background information or materials can be obtained. Student worksheets appear at the end of each lesson and may be reproduced as needed. The worksheet number appears in a circle in the upper outside corner of the page for easy identification. Answers for worksheets 3-2, 4-1, and 4-4 are in the Teacher Notes sections of those lessons. Answers for quizzes 5-4 and 10-1 are on a separate page following each quiz. Homework assignments provide continuity from one day to the next. Part A of most lessons refers to the previous day's homework assignment.

Several activities in this unit may need clarification:

Simulation Game: Simulation games are learning exercises that place students in roles similar to real-world situations. Playing the game requires them to make decisions as if they were part of those situations. Simulation games are meant to be fun as well as educational: players learn their roles as the game unfolds through the operation of the rules and the changing dynamics of the situation. The basic rule for directing a simulation is this: say no more than the few words necessary before the game to start it, during the game to keep it running, and after the game to keep the discussion going.[2]

Role Playing: Participants are assigned roles and are given a brief description of a situation they are to act out as they see fit.[2]

Brainstorming: Students give you their immediate and unedited responses to a question or statement. Responses are put on the board and no judgments or values are discussed until afterward. A free flow of ideas is important, and you should put all responses on the board without criticism. Only after the brainstorming is over should you and the students comment, refine, and edit.

Whip: You ask students to complete a statement such as "When I think of nuclear war, I . . . ." In quick succession, students either complete the statement or pass. Class discussion may follow.

APPENDICES

The Appendices to the Teacher's Guide contain information considered important to your understanding of the material in this unit. Appendix 1 contains lists of pertinent articles, books, organizations, and audiovisual materials. Teachers, of course, will have to decide whether particular materials are appropriate for their classes. Appendices 2, 3, and 4 contain fact sheets and background information which may serve as a primer for you or as supplemental material for particular lessons. A Teacher's Glossary (Appendix 5) provides definitions of many terms in the unit. A Students' Glossary (Appendix 6), which teachers may reproduce and make available, defines those terms which youngsters may find unfamiliar. A quiz on definitions may give teachers an additional grading opportunity. Appendix 7 provides for teacher comments on the unit, and Appendix 8 allows students to express their reactions. Finally, a sample letter to parents, which teachers may adapt, is included as Appendix 9.

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[2] Heyman, Mark. *Simulation Games for the Classroom.* Bloomington, Ind.: Phi Delta Kappa Education Foundation, 1977. Many pamphlets are available at low cost.

STUDENT EVALUATION

For grading purposes, the unit includes two quizzes (a quiz covering Lessons 1 through 5 at the end of Lesson 5 and a cumulative quiz at the end of Lesson 10), as well as homework assignments, worksheets, and a long-term class project. The writing of a daily journal is discussed in Lesson 1. The journal is a way for students to express their reactions, especially if they are uncomfortable with the material. The journal could also be used as the basis for a grade at the end of the unit. However, the grade given the journal should indicate its completion rather than evaluation of its ideas.

BEFORE YOU BEGIN THE UNIT

- Read the material in the Appendices to the Teacher's Guide. Understanding this material will help you teach the unit.
- Collect newspapers and magazines from which students can cut out pictures and articles to create their own bulletin board.
- Write your members of Congress (representatives and senators) or candidates for these offices. Ask their views on issues such as the nuclear freeze, no first use, the defense budget, and nuclear war. In Lesson 10, students may discuss and respond to the politicians' views with letters expressing their opinions on these issues.
- Find out what local resources are available, including films, speakers, and other special events. Try to identify speakers and local resources to provide contrasting points of view on the issues addressed in the unit. In Lesson 10, the students are asked to plan activities that may use these resources.

Lesson
1

NUCLEAR WAR—WHY WORRY?

LESSON CAPSULE:

Educating about nuclear war is the first step toward its prevention. Students are introduced to the atomic bomb and nuclear war by completing a survey with questions spanning topics addressed in the unit. In this lesson students encounter, perhaps for the first time, the destructive power of the atomic bomb.

Equipped with some knowledge of the effects of nuclear weapons, students then consider the reasons for studying war through the story of *The Hundredth Monkey.* The class learns that each individual's participation is an important contribution to the prevention of nuclear war. Students conclude by entering their feelings about the day's lesson in a journal.

PURPOSES:

- To create a classroom atmosphere that encourages the expression of student attitudes and feelings about nuclear war.
- To introduce the study of nuclear war and explain why such study is important.
- To study the effects of the atomic bomb on Hiroshima.
- To give students hope that their awareness of the dangers of nuclear war can help prevent it.

MATERIALS:

- Student Questionnaire—Worksheet 1-1.
- Mushroom Cloud handout—Worksheet 1-2.
- B.C. cartoon handout—Worksheet 1-3.
- Adaptation from *The Hundredth Monkey*—Worksheet 1-4.
- Hiroshima accounts (see Teacher Notes for this lesson).

DESCRIPTION OF LESSON:

★A. *Class Atmosphere.* It is important that you first establish an atmosphere of mutual trust in which feelings about conflict, war, and nuclear weapons can be expressed. Though the study of nuclear war can be uncomfortable on occasion, students should be able to expect class respect for their views.

★B. *Student Questionnaire.* Have students complete the questionnaire (Worksheet 1-1). This survey is meant to generate a discussion on nuclear war so that you may determine students' knowledge of this topic.

C. *Introduction.* This activity introduces students to nuclear war and its effects. It is assumed that they have little or no knowledge of nuclear war.

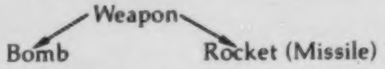
1. Distribute Worksheet 1-2 (Mushroom Cloud) to students.
2. Questions for discussion:
    a. What does the mushroom cloud mean to you?
    b. What produces a mushroom cloud?
3. Distribute Worksheet 1-3 (B.C. cartoon) to students.
4. Questions for discussion:
    a. In the cartoon what does B.C. mean when he says: "We can wipe it all out in six minutes?"
    b. About what world danger is Mr. Hart writing in this cartoon?
    c. What is nuclear war?

★D. *The First Atomic Bomb.* The following activity is very powerful. It is intended that students gain some cognitive and affective knowledge of the immediate devastation caused by a nuclear weapon. Though the first atomic bomb was much smaller than today's nuclear weapons, and therefore does not give a true picture of the extent of current destructive capacity, we will use the memories of atomic bomb survivors to educate ourselves and students about an event we hope to prevent from happening again.

1. Read one factual and one personal account of the dropping of the atomic bomb on Hiroshima. We recommend that you read Selection 1 *and* either Selection 2 or 3 in the Teacher Notes section. Introduce the word *hibakusha* (hē-bă'-kə-shă) as the Japanese word for survivor.
2. Divide the class into groups of four to five students.
3. Ask students to discuss their feelings about the Hiroshima accounts.
4. Have the groups list three or four things they felt after hearing these accounts.
5. Ask a spokesperson from each group to present the group's list to the class.
6. Allow students time to discuss their thoughts and feelings about Hiroshima and the atomic bomb.

★E. *Why Study Nuclear War?*

1. Inform students that the bombs we have today are even more powerful than the bomb dropped at Hiroshima. Distinguish here between *bombs* and *weapons*. Weapon is the the larger class which may be subdivided into bombs and rockets (missiles). A bomb is an explosive device which is usually dropped on a target from a plane. Other weapons have their own engine or means of propulsion.



2. It is also important here to distinguish between nonnuclear and nuclear weapons. *Nuclear* refers to the nucleus of the atom, the main source of the increased power of these weapons. Explain to students that people are concerned because of the perceived increase in the likelihood of nuclear war and a heightened awareness of its consequences. The United States and the Soviet Union possess over 17,000 strategic nuclear weapons. Over the next decade, both countries plan to build several thousand more strategic nuclear warheads. In 1960, Secretary of Defense Robert McNamara estimated that 400 one-megaton bombs would kill one-third of the Soviet people and destroy two-thirds of their industry. If only 400 weapons would destroy the Soviet Union, what would 17,000 weapons do to the world?
3. The following story helps students answer the question: Why study nuclear war? Students learn that one individual's action can help prevent nuclear war.

The story of *The Hundredth Monkey* is the account of an actual scientific experiment conducted in 1952. The experiment illustrates the concept of "critical number" whereby the attainment of a certain level or concentration causes some quality, property, or phenomenon to undergo a definite change. In this instance, a behavior exhibited by several monkeys is transmitted to the entire colony of monkeys.

This may be a difficult concept for students. You might illustrate "critical number" with the following demonstration:

> Fill a cup to the brim with water. With an eyedropper, add water to the cup drop by drop until it overflows. This final drop, together with the preceding volume, creates the critical amount of water necessary to make the cup overflow.

As the last drop of water was the one needed to make the cup overflow, so the hundredth monkey, in combination with the other 99, was needed for the whole colony of monkeys to learn to wash sweet potatoes. Once students understand the concept of the hundredth monkey and critical number, it is important to relate *The Hundredth Monkey* to the study of nuclear war. Increasing numbers of people learning about nuclear war (or any other topic) will one day reach a critical number. At this point, a definite change may occur in society's awareness of nuclear issues. Since we can never calculate the critical number, one individual joining with others really can make a difference.

a. Distribute copies of the adaptation from *The Hundredth Monkey*[3] to each student (Worksheet 1-4).
b. Have students read the story aloud or along with you.
c. Questions for discussion:
    (1) How did the knowledge of washing the sweet potatoes spread throughout the colony?
    (2) How did the adult monkeys learn to wash the sweet potatoes?
    (3) What happened when the hundredth monkey learned to wash the sweet potatoes?
    (4) What would be the effect of the hundredth monkey if the other 99 had not learned to wash the sweet potatoes?
    (5) How are people who learn about nuclear war like the monkeys who learned to wash sweet potatoes?
    (6) Can adults learn about nuclear war from young people?
    (7) How can knowing about the dangers of nuclear war help prevent it?
    (8) Does one person make a difference?

★F. *Journal.* Have students enter their thoughts and feelings about the lesson in a journal. This daily log allows students to express their reactions to the new material. It is particularly useful for students who may not wish to share their views in class. If students hand in the journals periodically, you may gain valuable information regarding their reactions to the unit. It is suggested that you collect the journals and that students enter their thoughts and feelings in them daily. Students might also enjoy giving a title to their journal. To encourage communication and sharing, you might read to the class your own first journal entry.

G. *Homework.* The exercise focuses on the special things that make life in the twentieth century exciting, interesting, and enjoyable.

---

[3] Keyes, Ken, Jr. *The Hundredth Monkey.* St. Mary, Ky.: Vision Books.

Have students build or imagine a time capsule in which to put 10 items they think would best tell the story of our life to people in the year 2000 A.D. Students might elect to make individual time capsules at home (a shoe box will do) or to contribute their special object to a class time capsule that could be filled at the beginning of Lesson 2.

H. *Optional Activities:*

1. Have students write an "Ask Beth" or a "Dear Abby" letter about "the five things that worry me most in the world today."
2. Ask students to complete the statement: "When I think of nuclear war, I . . . ." This would be a good introductory activity for students who have some knowledge about nuclear war. You could elicit responses at random or do a "whip" whereby each student answers the statement in turn. If students do not feel comfortable answering questions on their turn, they have the option of passing.
3. Have the class create an ongoing bulletin board on nuclear war, bringing pictures and articles from magazines and newspapers to class. This activity could easily be continued even after the unit is completed, providing the basis for future discussions.
4. *Unforgettable Fire* (Pantheon, 1977) presents pictures drawn by atomic bomb survivors 30 years after the event. Each picture is accompanied by a descriptive narrative. You may wish to share this book with your students. The memories recorded in these drawings are very powerful, and should therefore be used with considerable care in the classroom.

   If you use these pictures, you should allow time for discussion. In addition, we stress the importance of ending this lesson on a positive note, i.e., a reading of *The Hundredth Monkey* in Lesson 1, Activity E.3.

This activity could be inserted in Lesson 1 as part D.7.

D. 7.a. With the class still divided into groups of four to five students, distribute a packet of three to five drawings (with narratives removed) to each student.

b. Allow small groups to look at *all* the drawings in their packets.

c. Assign *one* picture to each group. Have the groups write three or four things they see happening in the picture.

d. Ask a spokesperson from each group to present the group's list to the class.

e. After each report, the teacher may wish to read to the class the survivor's narrative that accompanies the picture. It is important that the teacher judge the suitability of this material for students. A summary of the survivor's language may be more appropriate.

f. Allow students time to discuss their thoughts and feelings about Hiroshima and the atomic bomb.

TEACHER NOTES:

Atomic bombs were dropped on Hiroshima (8:15 A.M., August 6, 1945) and Nagasaki (11:02 A.M., August 9, 1945). The destruction of the two cities was largely complete. The focus of the first part of Lesson 1 should be on this unbelievable ruin.

It is important here to state the obvious—that individual teachers should decide how deeply to pursue the troubling issues raised in this lesson. The death and destruction in these two Japanese cities should not be glossed over; yet it should not become so dominant as to frighten students. For survivors of Nagasaki there is a special irony—being from the "second city," they are often overlooked.

The unit does not pursue the reasons for targeting populated cities. If the issue is raised, you will have to determine the extent of the discussion, recognizing that there are no certain or easy answers here.

We recommend that you read Selection 1 to the class for background information, in addition to either Selection 2 or 3.

Selection 1: Factual Account of the Dropping of the Hiroshima Bomb

In 1945, President Harry S. Truman was faced with a difficult decision. U.S. armed forces had been fighting in Europe and the Pacific and suffering large numbers of casualties. The U.S. had demanded unconditional surrender from the Japanese, but they had refused. Some of Truman's advisors argued that he had to choose between invading Japan and using nuclear weapons on Japanese cities. They said that up to a million American lives could be lost through an invasion, which would also delay the end of the war. This group of advisors recommended using nuclear weapons on Japanese cities in which production of war materials was the major activity. They said that using these weapons would shorten the war and save American and Japanese lives.

Other advisors said that invasion and nuclear use were not the only options. One group suggested that the U.S. demonstrate the power of nuclear weapons by exploding a bomb high over the city of Tokyo or on an uninhabited island. There, the mushroom cloud could be seen, but the fallout would be dispersed and the effects of the bomb would be limited. These advisors argued that after such a demonstration, the U.S. could again demand Japanese surrender. Only if the Japanese refused this opportunity would the U.S. use nuclear weapons on Japanese cities. A second group agreed that invasion or nuclear use were not the only options. However, they said that the United States should not demand unconditional surrender. These advisors argued that the Japanese would be unable to surrender on these terms, since tradition and history required that the Emperor be protected.

On August 6, 1945, the United States dropped an atomic bomb on the Japanese city of Hiroshima. It was the first time an atomic weapon had ever been used on people. Three days later, another atomic bomb was dropped on the Japanese city of Nagasaki.

Large sections of both cities were instantly leveled. A new disease called radiation sickness eventually killed many people who did not die in the original blast. The survivors still remember the "unforgettable fire," the horrible scenes of destruction, and the cries for help.

Selection 2: From the Introduction to Unforgettable Fire: Pictures Drawn by Atomic Bomb Survivors[4]

> On August 6, 1945, the morning started with a cloudless blue sky characteristic of the Inland Sea's summer . . . . Just before the fateful moment the seven rivers which ran through the city looked stagnant because of the high tide and reflected the deep blue of the summer sky.
>
> The Flash: 8:15
>
> The A-Bomb, which was nicknamed "Little Boy," was dropped from the B-29, Enola Gay. It exploded 570 meters above the ground with a light blue flash . . . Soon after the explosion black and white smoke covered the whole city and rose thousands of meters high. . . . Wooden houses within a radius of two

---

[4] From Japan Broadcasting Association, ed., *Unforgettable Fire: Pictures Drawn by Atomic Bomb Survivors* (New York: Pantheon Books, 1977), pp. 6–7. Copyright © 1977 by Pantheon Books, a Division of Random House, Inc. Reprinted with permission.

kilometers of the hypocenter collapsed and completely burned from the wind and heat. The fires continued for two days. Some people who were near the center of the explosion literally evaporated and only their shadows remained; others were turned to charred corpses. Those who survived were badly burned. . . . Friends and relatives trapped under collapsed houses were crying for help. . . .

Later large black drops of rain poured down. It was a deadly rain which contained mud, ash, and other radioactive fallout. Through burning flames and pouring black rain there was an endless line of injured people heading for the outskirts of the city. The burns on their hands made the skin hang down. Their hands looked like those of ghosts.

Selection 3: Child Survivor Account from Unforgettable Fire[5]

1. About 8:15 A.M. August 6, 1945
   As I looked up at the sky from the backyard of my house, I heard the faint buzzing of a B-29 but the plane was not visible. A few minutes later, the all clear was sounded. The sun was glaring in the cloudless summer sky, I looked up and suddenly saw a strange thing. There was a fire ball like a baseball growing larger becoming the size of a volleyball. And then something fell on my head. I realized it was something like a bomb showering my body. At that time I was 14 years old. . . .
2. How many seconds or minutes had passed I could not tell but regaining consciousness I found myself lying on the ground covered with pieces of wood. When I stood up in a frantic effort to look around there was darkness. Terribly frightened, I thought I was alone in a world of death and groped for any light. My fear was so great I did not think anyone would truly understand. When I came to my senses I found my clothes in shreds and I was without my "geta" (wooden sandals). . . .
3. Suddenly I wondered what had happened to my mother and sister. My mother was then 45 and my sister 5 years old. When the darkness began to fade I found that there was nothing around me. My house, the next door neighbor's house, and the next had all vanished. I was standing amid the ruins of my house. No one was around. It was quiet, very quiet, an eerie moment. I discovered my mother in a water tank. She had fainted. Crying out, "Mamma, Mamma," I shook her to bring her back to her senses. After coming to, my mother began to shout madly for my sister, "Eiko, Eiko!"

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[5] Ibid., p. 43.

Worksheet 1-1

STUDENT QUESTIONNAIRE

After each of the following statements, indicate whether you agree (A), disagree (D), or don't know (DK):

1. The United States and the Soviet Union have never been allies. A/D/DK
2. People can influence government policy. A/D/DK
3. Nations that have been enemies can become friends. A/D/DK
4. Arguing with someone is bad. A/D/DK
5. Disagreements between nations are usually settled by going to war. A/D/DK
6. The Soviets are more likely than the Americans to start a nuclear war. A/D/DK
7. Nuclear weapons used against another country will not harm people in the United States in any way. A/D/DK
8. The United States needs nuclear weapons to keep the peace. A/D/DK
9. The United States should spend more money on defense. A/D/DK
10. The information that I get from magazines, TV, and newspapers is always reliable. A/D/DK
11. Radiation from a nuclear bomb is harmful for only two weeks. A/D/DK
12. Human beings can create a peaceful world. A/D/DK
13. The only difference between an atomic bomb and a regular bomb is that the atomic bomb is more powerful. A/D/DK
14. A single person can affect the course of the future. A/D/DK

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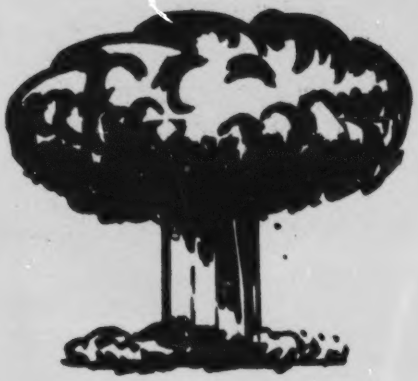
Worksheet 1-2

MUSHROOM CLOUD



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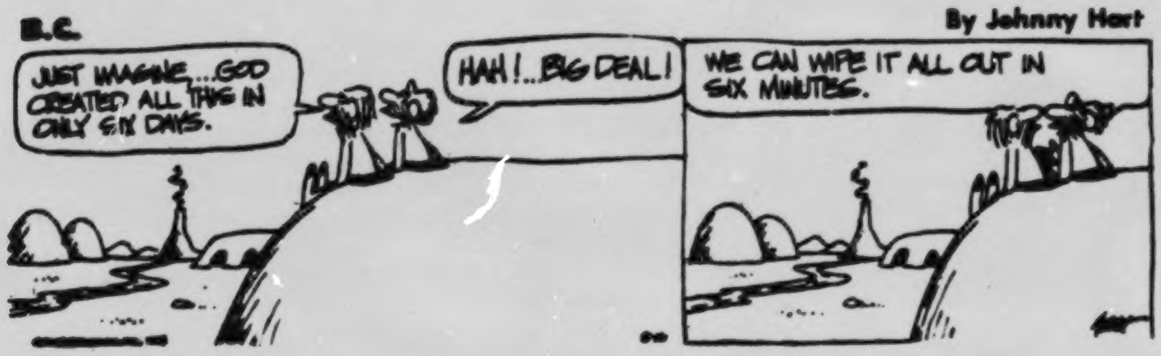
Worksheet 1-3


B.C.
By Johnny Hart
JUST IMAGINE...GOD CREATED ALL THIS IN ONLY SIX DAYS.
HAH!..BIG DEAL!
WE CAN WIPE IT ALL OUT IN SIX MINUTES.

By permission of Johnny Hart and Field Enterprises, Inc.

Worksheet 1-4

AN ADAPTATION FROM *THE HUNDREDTH MONKEY*•

Here is the story of the Hundredth Monkey. It was a scientific experiment.

The Japanese monkey, "Macaca fuscata," has been observed in the world for a period of over 30 years. In 1952, on the island of Koshima, scientists provided monkeys with sweet potatoes dropped in the sand. The monkeys liked the taste of the sweet potatoes, but they found the dirt unpleasant.

An 18-month-old female named Imo found that she could solve the problem by washing the potatoes in a nearby stream. She taught this trick to her mother. Her playmates also learned this new way and they taught their mothers, too.

This cultural innovation was gradually picked up by various monkeys before the eyes of the scientists. Between 1952 and 1958, all the young monkeys learned to wash the sandy sweet potatoes to make them more palatable. Only the adults who imitated their children learned this social improvement. Other adults kept eating the dirty sweet potatoes.

In the autumn of 1958, something startling took place. Though the exact number is not known, let us suppose that when the sun rose one morning there were 99 monkeys on Koshima Island who had learned to wash their potatoes. Let's further suppose that later that morning, the hundredth monkey learned to wash potatoes. THEN IT HAPPENED!

By that evening almost everyone in the tribe was washing sweet potatoes before eating them. The added energy of the hundredth monkey created a breakthrough! Thus, when a critical number achieves an awareness, this new awareness may be communicated from mind to mind.

Although the exact number may vary, the Hundredth Monkey Phenomenon means that when only a limited number of people know of a new way, it may remain in the minds of only these people. But there is a point at which if only one more person tunes in to a new awareness, the idea is strengthened so that it reaches almost everyone!

Your awareness is needed in preventing nuclear war.

You may be the "Hundredth Monkey" . . . .

•Ken Keyes, Jr. (St. Mary, Ky.: Vision Books).

Lesson
2

PERSONAL CONFLICT

LESSON CAPSULE:

Conflict is a natural part of daily life. Antagonistic forces meet, creating tension that needs resolution. This resolution can take many forms, of which war is the most violent. This lesson deals with conflict on a personal level. Students are presented with several conflicts between two persons. They examine the reasons why conflicts arise and how to solve them. Whether our opponent is perceived as a friend, enemy, or stranger may produce very different resolutions to the conflict. Through class activities, students will begin to understand the phenomenon of escalation.

PURPOSES:

- To understand that there are many solutions to a particular conflict.
- To explore the reasons why conflict arises.
- To understand that underlying assumptions about the other person in a conflict may affect the outcome.
- To encourage thought before action in solving conflicts.
- To begin consideration of compromise and negotiation as processes of conflict resolution.

MATERIALS:

- Conflict situations handout—Worksheet 2-1.
- Friend-enemy-stranger handout—Worksheet 2-2.

DESCRIPTION OF LESSON:

A. Review and discuss homework from previous day.

★B. *Conflict.* In this activity students will write endings to two conflict situations. As you generate on the board a list of ways in which conflicts are resolved, students will become aware of two things:
   - there are many different ways to resolve a particular conflict, and
   - there are several general strategies for resolving conflict.
   1. Mention to students that the tension they experience when there is a difference of feeling or opinion between two persons is called *conflict*.
   2. Distribute Worksheet 2-1 on conflict situations to all students.
   3. Divide the students into groups of four and then read through Situation 1. Ask each group to write an ending to the story.
   4. Ask each group to read their situation endings. As students respond, generate

on the board a list of the ways they chose to resolve the conflicts. You might write the particular resolution as well as a generalization of it. For example, a specific resolution of Situation 1 might be that Pat runs out and yells at the person who is riding her bike. A generalization of this might be that arguments (conflict) can be resolved by shouting at an opponent.

5. Ask students to read through Situation 2. Repeat the same process. Instead of asking the small groups to write an ending to the conflict, you may wish to have two students role-play the situation and ending(s). Continue adding to the list of ways in which people resolve conflicts.

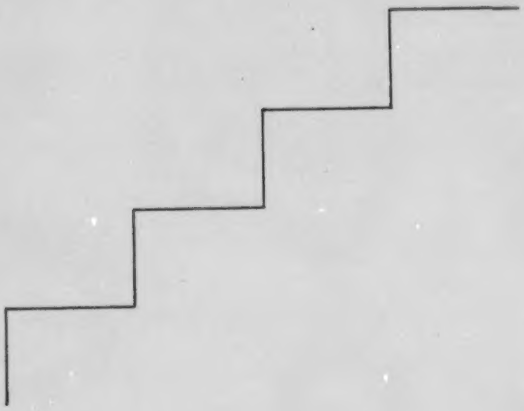
★C. *Friend, Enemy, or Stranger.* In this exercise students begin to examine the effects of knowledge and feelings about an opponent on the outcome of a conflict.

1. Use one of the situations from Worksheet 2-1 to initiate a discussion about the assumptions we make about our opponent in an argument or conflict. Ask students if the offended person's response would have been different if s/he had assumed or known that the opponent was a friend? An enemy?
2. Distribute the friend-enemy-stranger handout (Worksheet 2-2) to individual students.
3. Have students write three responses to each conflict, one assuming the opponent is a friend, the other an enemy, and the last a stranger.
4. Discuss student responses as a class. Ask. Does assuming the other person is an enemy produce the same result as assuming your opponent is a friend? Does eliminating a "me vs. you" attitude help resolve conflicts?

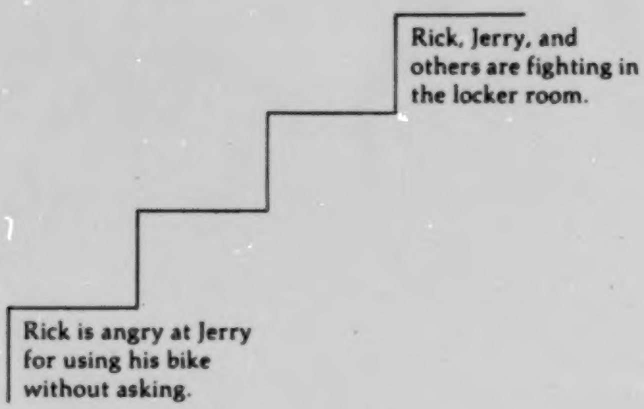
D. *Reasons for Conflicts.* Summarize activities B and C by creating a list of the reasons people get into conflicts. Use the conflict situations already discussed in the lesson to encourage students to consider the origins of conflict including money, jealousy, possessions, ideas, religion, and political beliefs.

E. *Escalation.* This activity shows how a disagreement between two people can escalate into a major conflict.

1. Draw the following staircase on the board.



2. Present students with the beginning and ending of a disagreement between two people. For example, the initial conflict might be: "Rick is angry at Jerry for using his bike without asking," while the final outcome could be: "Rick and Jerry and four of their friends are fighting in the locker room."
   a. Write the initial conflict on the bottom step of the staircase and the final outcome on the top step.


Rick, Jerry, and others are fighting in the locker room.
Rick is angry at Jerry for using his bike without asking.

   b. Have students generate a series of reactions which indicate the escalation from the original conflict to a locker room fight.
   c. Ask students:
      - Does thinking before acting lessen the possibility of escalation?

★F. *Journal.* If you have elected to use the journal, remind students to make their entries.

★G. *Homework.* You might introduce this assignment in the following way: Sometimes compromise is necessary to settle a conflict. When you *compromise,* each person gives up some of what he or she wanted at the beginning of the conflict. The process of talking to settle the conflict, whether or not you compromise, is called *negotiation.*

Ask students to write a one-page story about a time when:

1. They were in a conflict with someone and settled the conflict by negotiation without having to compromise,
   OR
2. They were in a conflict which was settled through compromise,
   OR
3. Negotiation occurred in a scene on a TV show,
   OR
4. Negotiation and/or compromise were used to settle a conflict in their family.

Worksheet 2-1

CONFLICT SITUATIONS

Situation 1

Pat had just finished delivering papers on her paper route. She was planning to meet some friends at the lake in five minutes but needed a change of clothes. Pat rushed home, dashed into the house, and grabbed a towel and some money. She was shocked when she returned to the front yard. The bike she had left in the yard was no longer there! Someone was riding it in the street in front of the house. What did Pat do?

Situation 2

Bif and Trish are strangers, but they often see each other at the local video game arcade. Bif is next in line to play Pac-Man, when Trish spots a friend who is playing the game in front of Bif. Trish and the friend start talking; the friend leaves and Trish is now ready to play Pac-Man ahead of Bif. What does Bif do?

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Worksheet 2-2

FRIEND-ENEMY-STRANGER

Read each situation. First, assume that the other person is your friend; write a resolution to the conflict. Next, assume that the other person is your enemy; again, write a response to the situation. Finally, assume that the other person is a stranger, and write a resolution of the conflict.

SITUATION	FRIEND	ENEMY	STRANGER
Someone calls you a "CREEP."			
Someone borrows your bike without asking.			
Some cuts ahead of you in line.			
You hear that Flash started a rumor about you that isn't true.			
You hear that one of your classmates was seen this afternoon in your yard and left the gate open Your dog is missing.			
You overhear someone in the locker room planning to break into the local record store tonight.			

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Lesson
3

GROUP AND NATIONAL CONFLICT

LESSON CAPSULE:

This lesson begins with a discussion of negotiation and compromise on a personal level and then examines conflict on larger levels within and between countries. Finally, weaponry in warfare is examined in terms of the evolution of technology and the degree of personal contact.

Group conflict is illustrated by playing the M&Ms game in which two groups compete for limited resources. Students discover that communication, negotiation, and compromise are necessary for nonviolent settlements.

Students then explore the reasons for national conflicts. They read three to five short scenarios of specific conflicts, and choose solutions they prefer based on both positive and negative consequences.

Finally, students match weapons used in conflicts through history with definitions and range of effectiveness.

PURPOSES:

- To examine conflict resolution and the role of negotiation.
- To demonstrate that resolution of disputes using communication and negotiation can lead to more desirable outcomes than resolution through violent means.
- To explore the reasons nations go to war and the means used to settle disputes.
- To experience decisionmaking and the weighing of alternatives, and to understand that decisions have consequences.
- To examine the evolution of weapons in terms of range of effectiveness and personal contact.

MATERIALS:

- M&Ms, approximately three to four times the class number (or Hershey kisses or small, colored squares).
- Case studies—Worksheet 3-1.
- Rocks to Nukes handout—Worksheet 3-2.

DESCRIPTION OF LESSON:

★A. *Conflict Resolution.* Discuss the homework from Lesson 2. Ask students to discuss conflicts they have witnessed in their lives or on TV. Ask:
   1. Who initiated the negotiation or compromise?

2. What happened if only one side was willing to negotiate or compromise?
3. What happened if neither side negotiated or compromised?
4. List some of the difficulties of negotiation or compromise.
5. List some advantages of negotiation or compromise.
6. How could you persuade someone to compromise if s/he were at first unwilling to do so?
7. Do you personally find it difficult to compromise? Why or why not?

★B. *The M&Ms Game.* This game illustrates the importance of communication, negotiation, and compromise. Students are asked to share "resources" that cannot be divided equally.

Divide students into groups of even numbers (preferably greater than four). Teachers can assign an observer to report to the class how the group splits the M&Ms. Each group splits into two equal teams or sides. Give each group an odd number of M&Ms (or Hershey kisses, or pennies), so that everyone gets a few and there is a remainder. One group can serve as a control by being given an equal number of M&Ms, if you wish. When you say "Go," the teams have one to two minutes to divide up the M&Ms between them *in silence.* Call time when all groups are finished. Record the time needed to reach a solution by all groups (or ask them to keep their own time). Play the game again, but allow communication between the two teams. Keep a record of the time for the second round as well. When all groups have finished, a spokesperson from each group should explain the results of the two rounds. Suggested questions:

1. How were the M&Ms divided up in round one? Who took control? Why do you think that particular person took control?
2. What happened to the extra M&Ms? Were they divided up by the person who took control?
3. How did the second round differ from the first? Did communication affect the game? If so, what was communicated?
4. What happened to the extra M&Ms in round two? Who divided them up?
5. Was there a difference in time between the two rounds? Why?
6. Is it easier to resolve conflicts when people communicate? If so, why?

★C. *Case Studies.* Pass out copies of Worksheet 3-1. In small groups (or at first individually), have students discuss three to five case studies of national conflict and choose between the alternatives. Students may also write in their own alternatives.

Emphasize that it is not always easy to make decisions when you are trying to resolve a conflict and that many conflicts do not present a clear choice of alternatives. Conflicts can persist for years because of events beyond the control of people making decisions today. In any complex society, a prime minister or president has enormous and often inflexible historical, cultural, and religious factors to consider.

After they check the alternative they desire, ask students to write both a positive and negative consequence of their decision. Groups should choose a spokesperson to present their arguments to the class.

D. *Reasons for War.* Ask students why nations go to war. Put their ideas on the board. Encourage them to consider the following:

1. territory
2. resources
3. political and religious beliefs
4. economic pressures

Next to the list of reasons nations go to war, list student ideas of how nations resolve conflicts, such as trade, treaty, or compromise. What happens when an increasing number of people want scarce resources?

★E. *Journal.* If you have elected to use the journal, have students make their entries.

F. *Homework.* For homework, pass out Worksheet 3-2 (Rocks to Nukes), and ask students to look at the list of weapons used throughout history. They are to fill in the chart with the definition of the weapon, and the face-to-face value, from 1 to 5.

1=arm's length or less from target
2=20 feet from target
3=50 to 100 yards from target (one-half to a full football field)
4=more than a mile
5=across the ocean

The face-to-face value is the maximum distance from which the weapon is effective. The target does not have to be another person; it could be a bull's-eye. The purpose of this exercise is for students to think about the personal and impersonal nature of weapons. Combat and warfare in past ages required more personal contact with the adversary. Nuclear weapons will be discussed in more detail in Lesson 4. (See Teacher Notes for explanation of biological and chemical weapons.)

G. *Optional.* This version of Tic Tac Toe involves cooperation, not competition, at a game. The game is played in groups of three, and all three players win or lose together.

Have students draw a tic tac toe board. Each person takes a turn and puts a number (1 to 9) in one of the squares. The object of the game is to have the columns, rows, and diagonals add up to the same number without using a number more than once. Students play as many times as it takes to construct the square.

Answer: The number 5 must go in the center and all the rows, columns, and diagonals must add up to 15.

6	7	2
1	5	9
8	3	4

TEACHER NOTES:

Biological weapons refer to pathogenic (disease-causing) microbes that can be disseminated over a target population in order to inflict mild to fatal diseases. The microbes are inhaled or ingested and the effects are less predictable than other weapons. Some of the diseases have moderately effective vaccines or antibiotics; many do not. Oxygen masks could be worn if adequate warning systems were developed. Diseases which may be caused by biological weapons include Eastern equine encephalitis, typhoid fever, anthrax, plague, and cholera.

Chemical weapons include lethal and sublethal gases sprayed over a population to render it defenseless. Chemical weapons were used in World War I. Since that time, they have been stockpiled by the United States and the Soviet Union, as well as several other nations. An example of a modern lethal chemical weapon is nerve gas (first developed, but not used, by the Germans in World War II) which is inhaled or becomes deposited on the skin and absorbed into the nervous system. Police tear gas is also in this category, but is not lethal. BZ (military abbreviation) is a chemical weapon that elicits unpredictable and often violent behavior; CS (military abbreviation) causes sensations of asphyxiation and acute anxiety, but is nonlethal.

Answers for Worksheet 3-2:

	1	2
ROCK	D	2
BOW AND ARROW	G	3
FIST	J	1
SWORD	C	1
RIFLE	E	4

	1	2
CANNON	F	4
KNIFE	A	1
NUCLEAR WEAPON	H	5
CHEMICAL WEAPON	I	4
BIOLOGICAL WEAPON	B	4

Worksheet 3-1

Choose the option that you think is the best solution for each case study. You may also write a different resolution. In addition, you must write both a positive and negative consequence of the resolution chosen.

CASE STUDIES[7]

Case One: People in your country are dying from the cold because of a severe shortage of heating oil. Another nation has plenty of oil but refuses to sell it to you. Would you:

Consequence
Positive *Negative*

_____ attack the other nation and take the oil?
_____ risk freezing (and possible uprising by your citizens)?
_____ I would rather _______________________

Case Two: A majority of people in your country have voted to outlaw your religion. You have tried many kinds of peaceful protests. Would you:

Consequence
Positive *Negative*

_____ fight to keep your religion?
_____ give up your religion to keep the peace?
_____ I would rather _______________________

Case Three: In your city, most of the people (including your parents) have jobs in a factory that produces wastes that make the drinking water unsafe. A group concerned about the environment asks people to vote for stricter laws. The plant will have to lay off many of its workers if the laws pass. Would you:

Consequence
Positive *Negative*

_____ vote for the laws to make the water safe?
_____ vote against the laws?
_____ I would rather _______________________

---

[7] From "Designing a New World Order" by Betty Reardon and Barbara Stanford, in *Peacemaking: A Guide to Conflict Resolution for Individuals, Groups, and Nations* (New York: Bantam, 1976). Reprinted with permission of Barbara Stanford.

Case Four: Your country, Andronia, makes machinery required by another country, Baslef, to pump oil to keep people warm in the harsh winters. Even though the project provides some jobs for Andronians, your country will lose a much more profitable trade agreement with a third country Crescent, if your country sells the machinery to Baslef. Would you:

Consequence
Positive *Negative*

_____sell the machinery to Baslef?
_____not sell the machinery?
_____I would rather________________________

Case Five: You are a poor farmer in a small country who makes a meager living raising food crops—potatoes, wheat, and beans—some of which you trade for wool. Someone from a richer country wants to pay you a lot of money to raise cattle to sell to them. Would you:

Consequence
Positive *Negative*

_____keep raising crops?
_____raise cattle?
_____I would rather________________________

Worksheet 3-2

ROCKS TO NUKES

Listed below are ten weapons humans have used in warfare over the ages. Historically, people have fought over religion, ideas, natural resources, or boundaries. As civilizations have evolved and populations increased, weapons have become more complex, more costly to produce, and more deadly. "Don't shoot until you see the whites of their eyes" is a saying which has less meaning today than in the past. Think about the differences among the ten weapons below as you fill in the chart.

In the first column, place the letter of the definition you think best describes the weapon. Use each letter only once. In the second column, put a number from 1 to 5 which describes the distance over which the weapon is most effective.

A. A short, thin, steel blade, very sharp
B. Microorganisms that are breathed in or eaten and that cause disease
C. A long, steel blade, very sharp
D. Small, mineral-based objects of no definite shape
E. Thick, hollow tubes of varying lengths that fire small leaded objects that penetrate the target
F. Large, heavy tubes used to fire huge leaded balls great distances
G. A long, skinny, pointed piece of wood with a stone tip, shot from a curved piece of wood with a string
H. A powerful, radioactive substance projected or dropped on a target resulting in both immediate and long-term damage
I. Powders, liquids, or gases breathed in or eaten that cause disease
J. A tight knot of knuckles

1=arm's length or less from target
2=20 feet from target
3=50 to 100 yards from target (one-half to a full football field)
4=more than a mile
5=across the ocean

	1	2
ROCK		
BOW AND ARROW		
FIST		
SWORD		
RIFLE		

	1	2
CANNON		
KNIFE		
NUCLEAR WEAPON		
CHEMICAL WEAPON		
BIOLOGICAL WEAPON		

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Lesson
4

DOES BIGGER MEAN BETTER?

LESSON CAPSULE:

This lesson takes conflicts and conflict resolution to the worst end point—nuclear war. Students examine various methods of warfare used throughout history and recognize that nuclear warfare represents a leap beyond all previous weaponry. Nuclear warfare is the most impersonal means of waging war. It is extremely sophisticated in terms of design and technology, and its consequences are extreme. Today many countries are developing their own nuclear capabilities.

What are the effects of nuclear weapons? After students recall their visions of Hiroshima, they compare that bomb with weapons in today's arsenals to understand the enormous power of present nuclear weapons. They then examine in greater detail the actual short- and long-term effects of a nuclear explosion on people and the environment.

PURPOSES:

- To compare nuclear weapons with past methods of warfare.
- To understand the growth in power of nuclear weapons.
- To understand the special nature of nuclear war.
- To examine the physiological, biological, and environmental effects of a nuclear explosion.

MATERIALS:

- Two small glasses (about 6 ounces), one per group of students.
- Food coloring (preferably dark colors, such as red, blue or green).
- Worksheet 4-1 on the nature of nuclear weapons.
- Worksheets 4-2 and 4-3 on the effects of nuclear weapons.
- Worksheet 4-4 for homework.

DESCRIPTION OF LESSON:

A. *Weapons.* List on the board the ten weapons from the homework assignment. Ask students for the letters of their definitions and briefly discuss biological, chemical, and nuclear weapons so that they understand the definitions. Discuss the face-to-face value with the class and reach a consensus on the numbers for each weapon. Ask students to consider the following when comparing one weapon to another:
   - the cost of production,
   - the number of victims,
   - the area of destruction, and
   - the possible defenses against attack.

B. *Nuclear Strength.* Ask students to review from Lesson 1 the effects of the bomb dropped on Hiroshima. This discussion gives an introduction to the nature and effects of nuclear weapons.

Distribute Worksheet 4-1 (Giant Steps—Forward or Backward?) on the nature of nuclear weapons. Have students do one or both exercises to compare the Hiroshima bomb with weapons in the present nuclear arsenal (see the Teacher Notes for this lesson for background material.)

★C. *Effects of Nuclear Explosions.* Distribute Worksheet 4-2 (Some Things Never Seem to End) and have students read about the effects of nuclear explosions. After students have read this worksheet, distribute Worksheet 4-3 (Radiation). Ask students to look at the two pictures and then discuss the long-term effects on those who are not immediately killed by the explosion.

This part of the lesson may be one of the most disturbing portions of the unit. The students have been given many unpleasant facts, but it is crucial to realize the destructive nature of nuclear weapons. In Appendix 4 we have reprinted a detailed *Scientific American* article on the effects of nuclear war. This article may be useful for you, for an advanced science class, or for students interested in learning more technical material.

★D. *Ground Zero.* Provide students with copies of a map or show an overhead projection of their city (or a nearby city) with concentric circles marking the zones of the effects of a nuclear explosion.

The data below detail the effects of a one-megaton bomb at different distances from ground zero (the point on the earth's surface on or above which a nuclear weapon explodes):

0 to 2 miles—total destruction, 99 percent immediate death rate, and a crater one-fourth of a mile wide and 20 stories deep;
2 to 3 miles—most buildings flattened, 50 percent immediate death rate, 25 percent delayed death rate, with most survivors badly injured or burned;
3 to 5 miles—many buildings flattened and 50 percent casualty rate (killed or injured);
5 to 10 miles—most buildings damaged, 25 percent casualty rate, at least second degree burns, and many victims blinded by the flash.

Within a 10-mile radius, people would be killed by firestorms (fires caused by the blast's great heat) or by asphyxiation (suffocation) as the fires consume oxygen. Lethal radiation would spread throughout the region and would contaminate areas up to 100 miles from the blast.

The above scenario is based on averages (a one-megaton weapon exploding at about 5,000 feet in good weather); individual sites have many variables (terrain, water bodies, etc.) which either compound or lessen the effects.[8]

You may choose to have students draw the concentric circles on the maps. If so, they will need compasses. You may also have to help students determine the correct scale for the map. Several examples of this type of mapping exercise appear in "The Prompt and Delayed Effects of Nuclear War," included in Appendix 4. Maps and tables of blast effects are also found in Edward M. Kennedy and Mark O. Hatfield's *Freeze! How You Can Help Prevent Nuclear War* (New York: Bantam, 1982).

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[8] Statistical information excerpted from the Office of Technology Assessment report, *The Effects of Nuclear War*, Washington, D.C., 1980.

★E. *Journal.* If you have elected to use the journal, remind students to make their entries. It is a good idea to check the journals at this time to be certain that students have understood the assignment.

F. *Homework.* Worksheet 4-4 (When Less Is More). The homework assignment emphasizes the growing number and increased power of nuclear weapons. It may be useful to compare the height of all the nuclear weapons taken together to a local landmark, such as a tall building or high hill or mountain.

TEACHER NOTES:

Nuclear weapons are carried by one of several means to targets. Their source of enormous power is located within the nuclei (centers) of the atoms making up the weapons. There are two basic types—the so-called atomic bombs and hydrogen bombs.

Atomic Bomb. An atomic bomb, like those dropped on Hiroshima and Nagasaki, releases its power through fission, the splitting apart of uranium or plutonium atoms. One pound of uranium releases explosive power equivalent to 8,000 tons of TNT (trinitrotoluene). The key to creating an atomic explosion is bringing enough nuclear fuel (the critical mass) together at the right moment. Particles (neutrons) are naturally emitted by the nuclei of radioactive atoms. These particles then hit the nuclei of adjoining atoms, causing them in turn to split and emit neutrons and so on. This is the chain reaction that triggers a nuclear explosion.

Hydrogen Bomb. Today's nuclear arsenals consist of fusion or hydrogen bombs which release many times more energy than atomic bombs. With fusion, smaller atoms of hydrogen combine or fuse to form a heavier element (helium). Since hydrogen bombs use a different process to produce energy, a smaller amount of material can be used to produce more powerful weapons. Most fusion weapons are started by small fission weapons that generate the enormous heat required to get the fusion reaction going.

Einstein. Some students will have read about Albert Einstein and will be acquainted with his ideas. Einstein saw mass as a special form of energy. Nuclear weapons illustrate this point better than anything else. In fusion reactions, the initial atoms to be combined weigh more than the resulting atom; the "lost mass" has been converted to energy.

Explosive Power. The standard means for expressing explosive power is in tons of TNT. The Hiroshima bomb was about 13 kilotons (kilo=1,000), or 13,000 tons of TNT. Many of today's weapons are much larger and use a correspondingly larger unit, the megaton (mega=1,000,000). The bomb dropped on Hiroshima is now considered a small weapon.

Radiation. Students may want to know the difference between a ground burst and an air burst. A ground burst generates more radiation and fallout than an air burst.

When a weapon explodes at the earth's surface, large quantities of dirt are drawn into the mushroom cloud. Since this dirt mixes with the radioactive residues of the explosion at an early stage, the radiation effect is substantial. The heavily contaminated dirt and debris later falls back to the earth ("fallout").

An air burst draws less dirt into the cloud and at a later stage. The dirt mixes less efficiently with the residues of the explosion. Much of the radiation that results is dissipated throughout the atmosphere. The fallout is accordingly less intense and smaller in quantity.

Notes on Student Worksheets. There are many ways to help students comprehend what "a million times greater" means. The exercise offered has students figure the length of a million inches in miles or how long it takes to count to one million at the rate of one number per second. Comparing the effect of one drop and then ten drops of dye in like volumes of water is a way to begin to compare the Hiroshima bomb with today's weapons; it is qualitative and not quantitative.

Answers for Worksheet 4-1:

1.a. 16 miles (15.8 miles)
b. 12 twenty-four hour days
3.a. 250 times stronger
b. 25,000 Hiroshima bombs

Answers for Worksheet 4-4:

1.a. 80,000 feet
b. 15 miles
c. 8,000 stories

Worksheet 4–1

GIANT STEPS—FORWARD OR BACKWARD?

When small atoms combine to form a larger one, they give off tremendous amounts of energy. This is called *fusion* and is what makes modern nuclear weapons so powerful. Fusion also occurs in the center of the sun, giving us heat and light. There are several important differences between the effects of fusion in the sun and the effects of fusion in nuclear weapons. Energy produced in the sun's center travels half a million miles to the surface, losing power all along the way. It loses more power coming almost 100 million miles to our planet. The earth's atmosphere protects us even further. The energy of a nuclear explosion is not changed in any of these ways. Its full effects are felt for many miles. It is strange, but true, to think that life's energy source (the sun) and the energy source for most deadly weapons (nuclear weapons) are the same.

Today our weapons are much larger than the atomic bombs of 1945. Below are three ways you can compare the sizes of weapons.

1. Together all the nuclear weapons in the world have one million (1,000,000) times more power than the bomb dropped on Hiroshima. One million times larger is a lot—it's hard to understand! Can you figure out how many miles long a line will be that is a million times longer than one inch? (Hint: 5,280 feet=1 mile.) Or try to figure out how many days it would take you to count to one million if you could count one number per second.

2. Fill two containers with water. Be certain that each container has the same amount. To the first add one drop of food coloring; to the other add ten drops. Look at the difference in color. The much greater effect of the ten drops gives us a way to compare today's weapons to the first atomic bomb.

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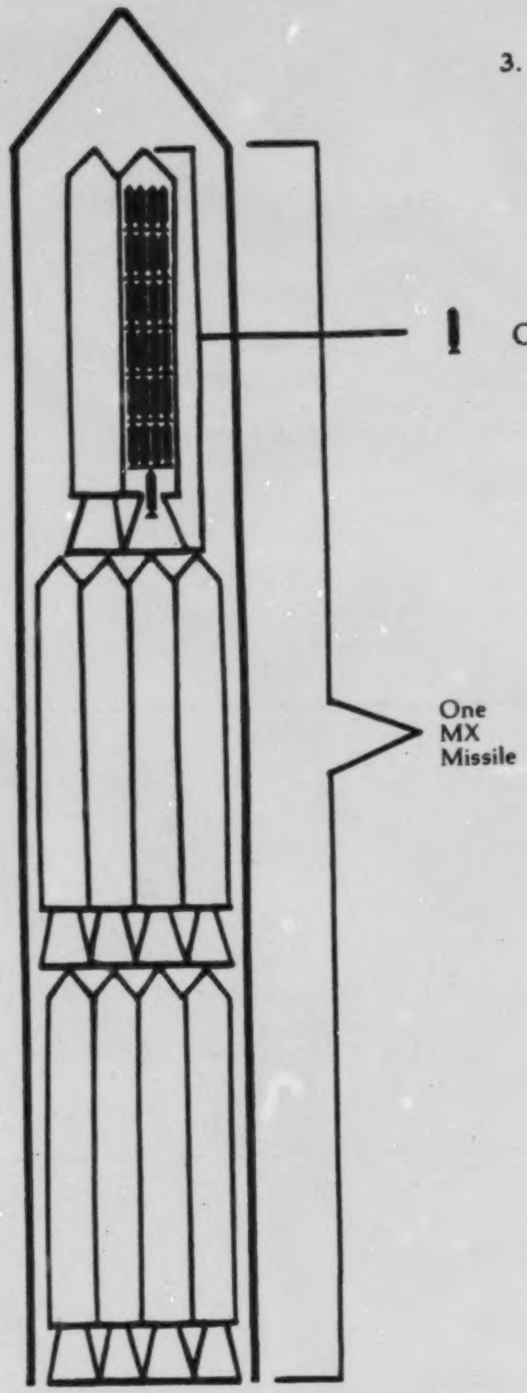
3. One warhead in the new MX missile is about 25 times stronger than the Hiroshima bomb. Each MX missile alone carries ten warheads! Look at the symbols of the Hiroshima bomb and the MX missile.



a. How many times stronger than the Hiroshima bomb is the MX?

b. Plans now call for 100 MX missiles; how many Hiroshima bombs would that be?

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Worksheet 4–2

SOME THINGS NEVER SEEM TO END

It is not very pleasant to think about the effects of nuclear weapons. The effects of a nuclear explosion are both immediate and delayed.

Immediate: As soon as a nuclear weapon explodes, a very hot fireball forms. The fireball vaporizes (turns to gas) almost anything it touches. As the fireball expands, it sends out an incredibly strong wind in all directions, destroying buildings and people. The intense heat of the fireball burns everything nearby and may start fires many miles away from ground zero. About two-thirds of a nuclear weapon's effects are immediate.

Delayed: The remaining third of the effects of a bomb explosion is mostly in the form of radiation. The amount of damage done by radiation is determined by the strength of the explosion, the amount of exposure (the time you're in it), and how close you are to ground zero. Radiation is a type of energy like X-rays. You can't see, hear, or feel it; yet it enters any objects it reaches. Radiation can even damage people's genes, affecting future generations.

Radiation sickness follows exposure to heavy radiation. People generally lose their appetite and hair, are constantly nauseated, and eventually die. In addition, after an explosion, dirt is pulled up into the mushroom cloud and becomes radioactive. The radioactive material goes into the atmosphere, spreads out, and then falls to earth. This "fallout" affects our water, soil, and food. Even if you live far away from an explosion, you can still be affected.

Radiation can stay around for many years. Although it is always getting weaker, some radiation remains harmful for a long time. When we take in any food or water that has been affected, some of the radiation may stay in our bodies. Radiation that enters our bodies in this way may also make us sick.

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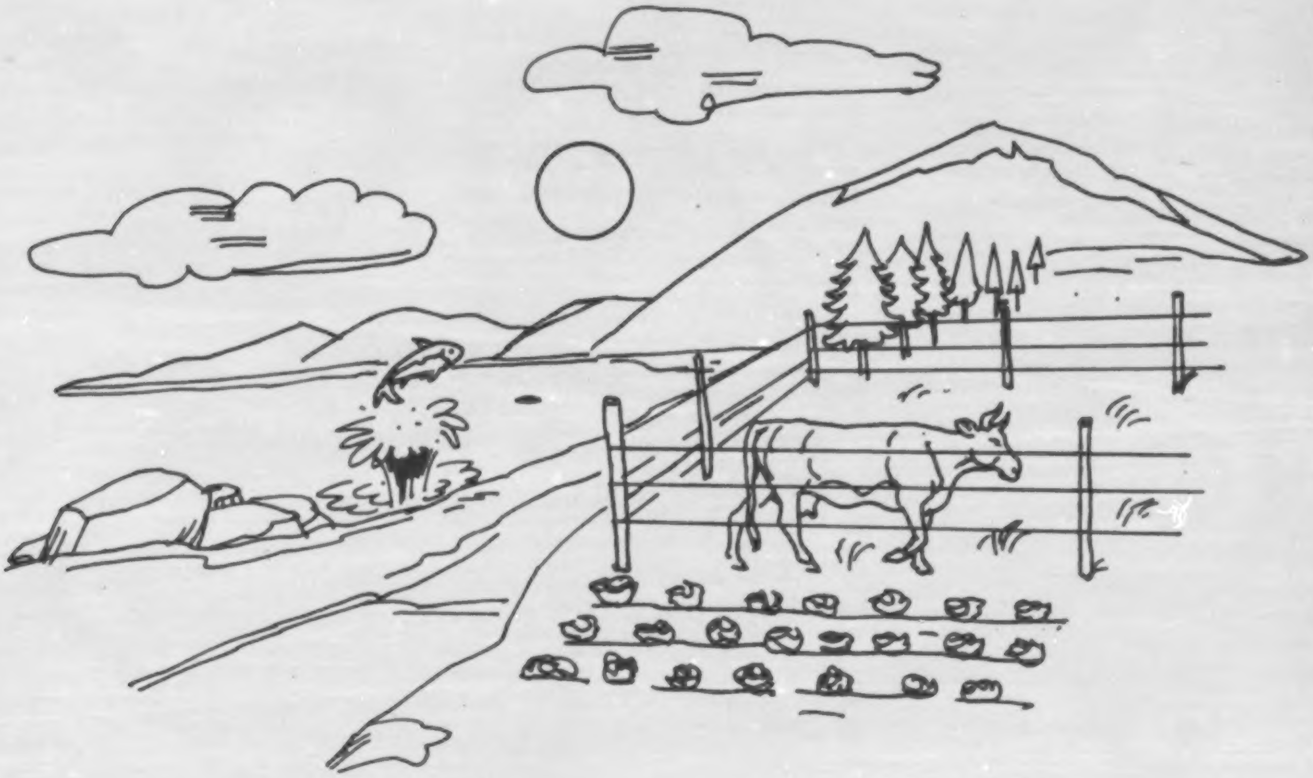
Worksheet 4-3

RADIATION

1. Look at the picture below and consider the effects of radiation.



a. Put an "R" everywhere you believe radiation would have an effect.

b. Which things in the picture do we depend upon?
Which things do we eat? What do they depend upon?

c. For each item listed above, discuss how you could be affected by the radiation that entered that item.

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Worksheet 4-4

WHEN LESS IS MORE

1. The United States and Soviet Union have more than 16,000 weapons. An average nuclear weapon is about five feet long.

   a. If stacked on top on one another, how many feet high would they reach?

   b. Try changing your answer to miles. (Hint: 5,280 feet=one mile.)

   c. If stacked beside a building, how many stories high would that building be? (Hint: A story is ten feet.)

2. Read the following carefully.[*] We will discuss the information in class tomorrow.

A one megaton explosion	*But equal energy is released by:*
is the energy equivalent of exploding one million tons of TNT.	a suitcase containing about 130 pounds of uranium or plutonium—A-bomb explosive—
One million tons of TNT would fill a very long freight train.	or a suitcase containing 20 to 60 pounds of thermonuclear H-bomb explosive.
The string of boxcars would be 300 miles long.	
The train would take 6 hours to pass at full speed.	

---

[*] *The Price of Defense*, The Boston Study Group. (New York: Times Books, 1979.)

Lesson
5

CAN YOU TOP THIS?

LESSON CAPSULE:

After discussing the growth in power and number of nuclear weapons from Lesson 4, students graph the escalation in combined U.S.-USSR strategic weapons over the last 35 years. Students extend the line to predict 1985 and 1990 weapons levels. Background is provided on technological and political change during the nuclear age. Students then play the natural resources-armaments game: weapons can be traded at the expense of natural resources. Class discussion following the game may stress potential economic costs of arms escalation. A mapping exercise on the proliferation of nuclear weapons is the final exercise. An optional quiz on Lessons 1 through 5 is included.

PURPOSES:

- To study the escalation of the nuclear arms race.
- To introduce some of the economic effects of arms escalation.

MATERIALS:

- Worksheet 5-1 on nuclear escalation and technological developments.
- Worksheet 5-2 for the natural resources-armaments game.
- Worksheet 5-3 on nuclear proliferation.
- Worksheet 5-4 for the quiz on Lessons 1 through 5.

DESCRIPTION OF LESSON:

A. *Nuclear Weapons Growth.* The twofold purpose of Lesson 4's homework is to dramatize the growing power and the increasing numbers of nuclear weapons. The work may be done in class if the math is too difficult. Ask students to consider the following questions:
   - How might continued growth in the power of nuclear weapons affect the world?
   - How might continued growth in numbers of nuclear weapons affect the world?

★B. *Arms Escalation and Technological Developments.* Distribute Worksheet 5-1 (Up, Up, and Away!) and have students plot the data to show the growth of U.S.-USSR strategic weapons from 1945 to the present.[10] When completed, the graph should appear as on the following page.

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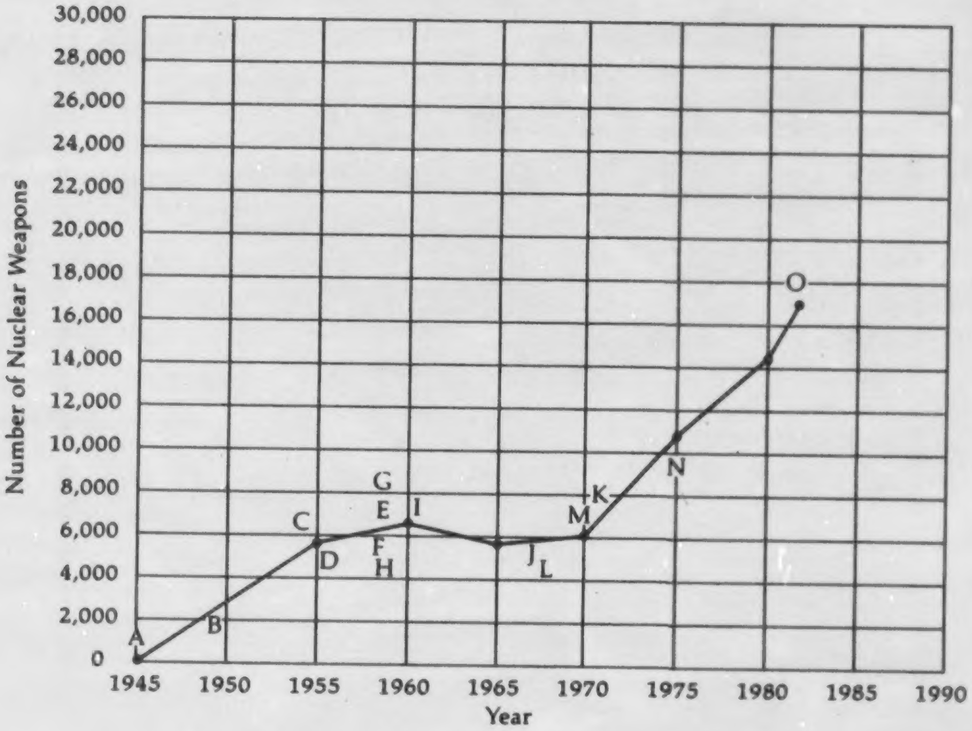
[10] The data are approximate; they have been compiled from several sources.



The students will then extend the trend line for 1985 and 1990. They are also asked to suggest alternative ways to draw the line and the reasons for the paths chosen.

There are three ways to continue the graph trend line—upward (at a constant or changed rate), level, or downward. Each choice implies a set of beliefs or feelings about the arms race. An upward trend suggests a continued arms race, a leveling off implies a freeze at current levels of armaments, and a downward trend could mean reduction by arms control or by use of nuclear weapons. The discussion that follows should focus on those points.

The arms escalation exercise emphasizes the increasing number of nuclear arms; the game that follows relates to depletion of resources. Proliferation—the spread of nuclear weapons to countries not now possessing them—is not the primary issue, although one scenario for the beginning of a nuclear war has proliferation as the backdrop. For example, a smaller country or terrorist group might initiate a conflict that escalates to nuclear war with superpower involvement.

When the graph is completed the students may then put the technological time line information along the trend line. Each event is symbolized by a capital letter. The letter is to be placed on the graph to correspond with the year of that event. In the preceding sample graph all the U.S. entries have been made above the trend line, the USSR entries below. Students may find other ways to show this point-counterpoint scheme (for example, different colors). What evolves is an action-reaction pattern explaining continued escalation. A more detailed version of the time line follows; some teachers may want to provide copies of this outline to their students.

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The time line[11] below provides an outline of the arms race.

ACTION ⇄ REACTION
in the Nuclear Competition

The dynamics of the nuclear arms race ensure that development of a new weapons system by one power will in a relatively brief period be followed by a comparable achievement by the other. Both powers have had "firsts". Neither has stayed ahead for long. The US generally has a technological lead of several years, but the futility of the race for short-term advantage is demonstrated by a chronology of developments to date.

US 1945 atomic bomb 1949 USSR

The nuclear age began with the explosion of a US A-bomb of 12.5 kilotons (equivalent to 12,500 tons of TNT) over Hiroshima, Japan. The single bomb, which destroyed the city, introduced to the world a concentrated explosive force of unprecedented power. Within four years, the USSR conducted its first atomic test.

US 1948 intercontinental bomber 1955 USSR

By 1948, the US had begun to replace the propeller planes of World War II with long-range jets. The first planes developed for strategic (intercontinental) bombing required refueling to reach another continent. In 1955, the US began deployment of the all-jet intercontinental bomber, and USSR soon followed suit.

US 1954 hydrogen bomb 1955 USSR

The H-Bomb multiplied the explosive force of the A-bomb 1,000 times. The first US thermonuclear bomb had a yield equivalent to 15,000,000 tons of TNT; a year later the USSR tested a bomb in the million-ton range.

USSR 1957 intercontinental ballistic missile (ICBM) 1958 US

Following intensive development by both nuclear powers, a land-based missile to carry nuclear warheads intercontinental distances was successfully flight-tested by the USSR in 1957, and by the US a year later. By 1962 both nations had ICBM's with a range of 6,000 miles, each missile able to carry a payload equivalent to 5-10,000,000 tons of TNT.

USSR 1957 man-made satellite in orbit 1958 US

Sputnik I by the USSR initiated a space race which quickly took on military functions; the first US satellite was launched into orbit the following year. Well over half the superpowers' satellites have been military: for surveillance, targeting, communications, etc.

US 1960 submarine-launched ballistic missile (SLBM) 1968 USSR

A nuclear-powered submarine which could fire long-range missiles from a submerged position was the third means of strategic delivery. The US produced the nuclear-powered Polaris, with missiles with a range of 1,200 nautical miles. Eight years later the USSR had comparable nuclear subs.

US 1966 multiple warhead (MRV) 1968 USSR

Multiheaded missiles increased the number of targets a missile could hit. US MRV'd missiles carried three warheads, each with sixteen times the explosive force of the Hiroshima bomb. The USSR had them two years later.

USSR 1968 anti-ballistic missile (ABM) 1972 US

The USSR deployed 64 defensive missiles around Moscow. The US began construction of the Safeguard system in 1969 and had one site completed when a treaty restricting ABM's was signed in 1972. Generally judged militarily ineffective, ABM's were restricted to one site in each country in 1974. Subsequently the US site was closed.

US 1970 multiple independently-targeted warhead (MIRV) 1975 USSR

Further development of multiple warheads enabled one missile to hit three to ten individually selected targets as far apart as 100 miles. USSR began to flight-test MIRV's three years after US put them in service and in 1975 began deployment.

US 1982 long-range cruise missile 198? USSR

Adaptable to launching from air, sea, and land, a new generation of missiles with a range up to 1,500 miles is in production. The cruise missile is small, relatively inexpensive, highly accurate, with the unique advantage of very low trajectory. Following the contours of the earth, and flying under radar, it will be able to destroy its target without warning. The US is reportedly 7-8 years in the lead in this technology.

US 1983 neutron bomb 198? USSR

This nuclear weapon releases its explosive energy more in the form of an invisible, penetrating bombardment of radiation rather than in heat and blast. The decision to produce and stockpile the enhanced radiation warhead in the US was announced in August 1981. The USSR promptly announced that it has the capability but had deferred a production decision.

US 199? anti-satellite weapons 198? USSR

Because satellites play vital military roles, they have also inspired a search for weapons to destroy them. The USSR began testing intercepter satellites in 1968. Both superpowers are attempting to perfect lasers to destroy enemy satellites and nuclear missiles in event of war.

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[11] Excerpted from *World Military and Social Expenditures 1981* by Ruth Leger Sivard, © World Priorities, Leesburg, VA 22075 USA.

★C. *Political Changes.* The nuclear arms escalation cycle has taken place against a background of worldwide political change. Provide students with a partial or full version of the following table listing some of the key political events since 1945. You may want to supplement this time line with some notations of your own. The information may be given to students as a handout or as a list on the board. Have students look at their graphs from the previous exercise (Worksheet 5-1) and see where or how these political events corresponded to changes in technology and weapons levels. Discussion should focus on how political events may influence the arms race.

Political Events Time Line

1947	Soviet-backed coup results in Communist government in Czechoslovakia.
1948	Soviet Union blockades Berlin.
1950	North Koreans invade South Korea.
1952	United Kingdom tests atomic bomb.
1960	Sino-Soviet rift. France tests atomic bomb.
1961	U.S. military involvement in Vietnam begins.
1962	Cuban Missile Crisis.
1963	U.S. and Soviets sign "hot line" agreement establishing a direct communications link between the two countries. Atmospheric test ban treaty signed.
1964	China tests atomic bomb.
1968	Soviets invade Czechoslavakia.
1972	SALT I Interim Agreement signed.
1974	India tests atomic device. Threshold Test Ban Treaty signed (not yet ratified).
1975	Cuban invasion of Angola.
1979	SALT II Treaty signed (not yet ratified). Soviets invade Afghanistan.

D. *Natural Resources-Armaments Game.* Distribute Worksheet 5-2. Directions for the natural resources-armaments game[12] follow: Divide the class into groups of five or more students. One person is to serve as the game director. Players are not allowed to see each other's papers. There are 20 moves in the game. Each player begins with 20 natural resources. At each move a player may move one natural resource to the arms pile or one armament back to the natural resources—just put a line through the natural resource tally to indicate you have moved it. A player may pass and make no move. A player may not shift more than one tally during a game move. The game director calls out "move one" and players move or pass, "move two," and so on. Any player who has three armaments may declare war on any other player (this cannot happen until "move four" begins). The winner of the war is the one with the most arms; the winner gains a natural resource and the loser loses a natural resource. However, both the belligerents lose all their arms. The armaments are destroyed and cannot be replaced.

If both nations have the same number of arms, both lose all their arms plus one natural resource. What is lost does not go to anyone else. It is just crossed off. At the end of the game (after 20 moves), the winner is the person with the most natural resources. Arms do not count in figuring the winner.

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[12] Gallagher, Mary Beth, and others. *Educating for Peace and Justice: A Manual for Teachers.* 5th ed. (p. 159). St. Louis: Institute for Education in Peace and Justice, 1976. (1981 edition available.) Game directions used with permission of Institute for Peace and Justice.

Students may develop innovative ways to play this game—negotiations, alliances, etc. When finished, discussion should focus on the game's primary point—that it is impossible to win by making war!

★E. *Proliferation.* A mapping exercise to show the proliferation of nuclear weapons is included on Worksheet 5-3 (Button, Button, Who's Got the Button?).[13] Countries are placed in four groups based on when they could develop nuclear weapons. Students are to locate the countries on the map. Countries in each group should be marked with the same color and that color should be put in the key. The completed maps provide an introduction to proliferation. Questions for discussion:

1. How do nonnuclear countries feel about those that have nuclear weapons?
2. What effect might weapon programs have on the economy and development of a small country?
3. What are the dangers of nuclear weapons in countries with unstable governments?
4. Where in the world are most of the nonnuclear countries located?
5. The Soviet Union and the United States have about 15 percent of the world's population and most of the nuclear arms. What power do they hold over the other nations?

★F. *Journal.* If you have elected to use the journal, remind students to make their entries.

G. *Homework.* Have each student write a one-page letter to the U.S. or Soviet government expressing his/her concern about nuclear war. The letters may be shared the next day. If some students desire, you may want to find out about forwarding the letters to the respective governments.

H. *Quiz.* If you elect to use the quiz, distribute it (Worksheet 5-4) to students. The time needed to complete the quiz will vary depending upon the class. It covers material from Lessons 1 through 5. Teachers may choose to add their own essay or short-answer questions.

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[13] Nye, Joseph S., Jr."Nuclear Weapons Proliferation: Too Late to Stop It?" *Boston Globe.* June 21, 1981.

Worksheet 5-1

UP, UP, AND AWAY!

In 1945 only the United States had nuclear weapons. Today the United States, Soviet Union, Great Britain, France, China, and India are known to have such weapons. Others are developing similar capabilities. The United States and Soviet Union are still the "leaders" with most of the world's nuclear weapons in their arsenals.

1. Plot the following information on the graph:

Combined number of strategic weapons for the United States and Soviet Union

Number of Weapons	*Year*
3	1945
No data available	1950
5,500	1955
6,600	1960
5,600	1965
6,000	1970
10,600	1975
14,300	1980
17,000	1982

2. When the above information has been plotted on the graph, enter the following time line developments along the graph's line. Place the capital letter used to designate each event at the appropriate year along that line.

Key Dates for Technological Developments

(Symbol)	*U.S.*		*USSR*	(Symbol)
A	1945	Atomic Bomb	1949	B
C	1954	Hydrogen Bomb	1955	D
E	1958	ICBM	1957	F
G	1958	Man-Made Satellite in Orbit	1957	H
I	1960	Submarine Launched Ballistic Missile	1968	J
K	1972	Anti-ballistic Missile	1968	L
M	1970	Multiple Independently-targeted Warhead	1975	N
O	1982	Long-Range Cruise Missile	198?	–

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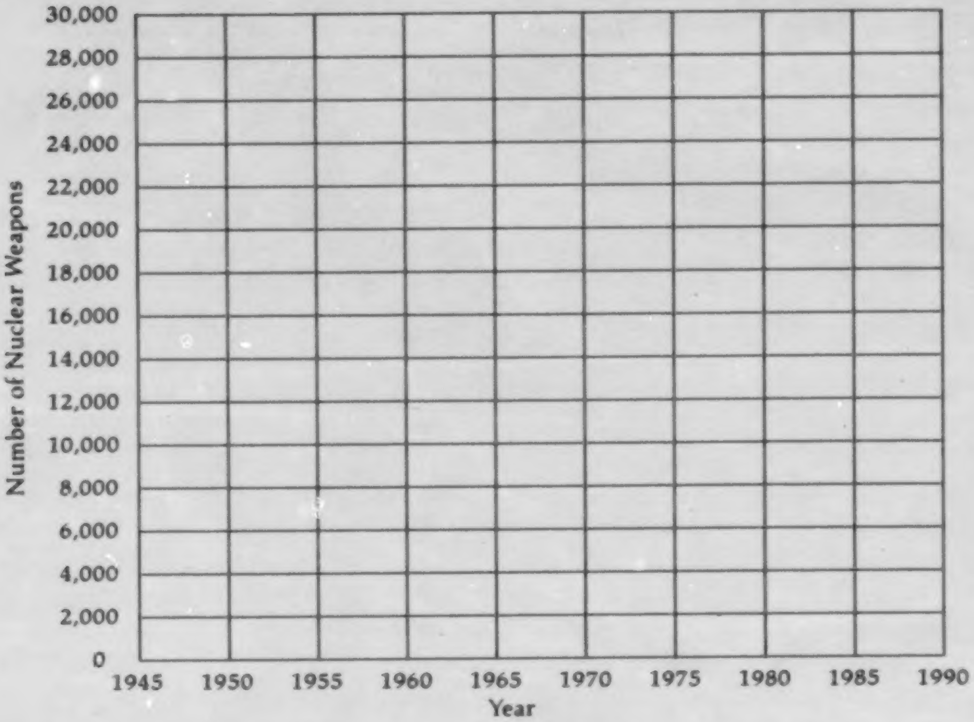

3. Continue the line as you think it will look in 1985 and in 1990.

4. Is there another way the line could be drawn? What will that depend upon?

5. When the time line information is put on the graph, do you see any pattern? Would this influence the way you might draw the line past 1982?

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Worksheet 5-2

NATURAL RESOURCES-ARMAMENTS GAME

NATURAL RESOURCES	ARMAMENTS
11111 11111	
11111 11111	

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Worksheet 5-3

BUTTON, BUTTON, WHO'S GOT THE BUTTON?

Proliferation is the spread of nuclear weapons to countries that do not have them now. Today there are six nuclear countries. They are listed in Group 1 below. It is believed some other countries are able to build nuclear weapons right now. They are in Group 2. Groups 3 and 4 list countries that could build nuclear weapons in the future.

Group 1—Countries with nuclear weapons: United States, Soviet Union, Great Britain, France, China, and India.

Group 2—Countries believed capable of building nuclear weapons: Canada, Sweden, West Germany, Israel, Pakistan, South Africa, Switzerland, and Japan.

Group 3—Countries that could have nuclear weapons within six years: Brazil, Argentina, Spain, Belgium, Netherlands, Denmark, Finland, Italy, Austria, Iraq, Taiwan, South Korea, and Australia.

Group 4—Countries that could have nuclear weapons in seven to ten years: Libya, Egypt, Norway, and Yugoslavia.

On the world map that follows find all the countries of Group 1. Color all those countries the same and put that color in the key box. Find all the countries for Group 2. Color them with a different color from Group 1. Put Group 2's color in the key box. Follow the same directions for Groups 3 and 4.

1. Which continents contain most of the nuclear countries? Why do you think that is so?

2. Do you think some of the other countries would like to have nuclear weapons? Why do you think that is so?

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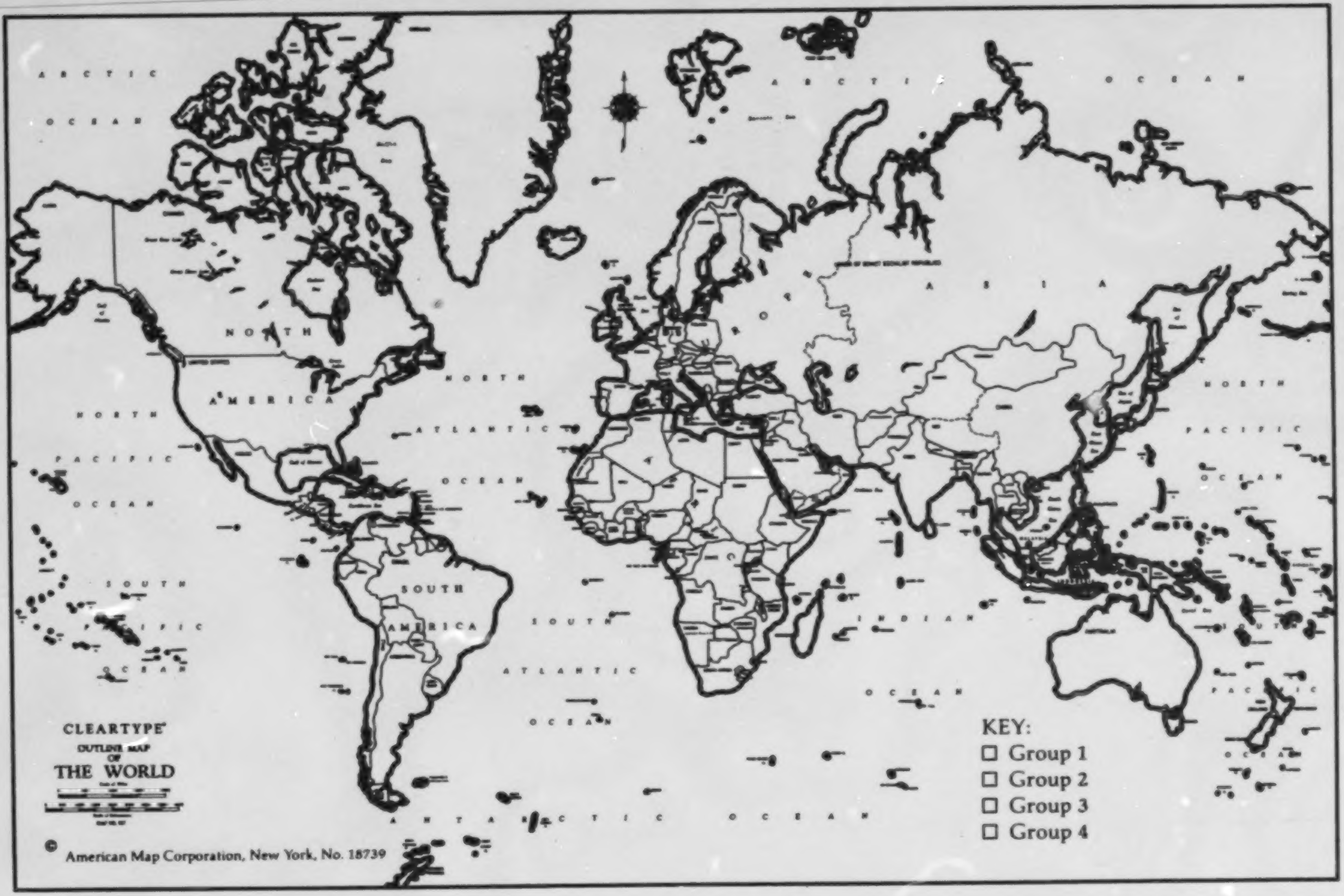
ARCTIC OCEAN
NORTH AMERICA
NORTH PACIFIC OCEAN
NORTH ATLANTIC OCEAN
SOUTH AMERICA
SOUTH PACIFIC OCEAN
SOUTH ATLANTIC OCEAN
EUROPE
ASIA
INDIAN OCEAN
NORTH PACIFIC OCEAN
PACIFIC OCEAN
ANTARCTIC OCEAN

CLEARTYPE
OUTLINE MAP
OF
THE WORLD

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KEY:
☐ Group 1
☐ Group 2
☐ Group 3
☐ Group 4

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Worksheet 5-4

QUIZ

Directions: For questions 1 through 5, choose the best answer and write its letter in the answer space.

For questions 6 through 10, fill in the blank to complete the sentence.

_____1. Radiation sickness is caused by (a) nuclear fallout, (b) electricity, (c) sitting too close to a radiator, (d) TV.

_____2. Fusion is (a) splitting of atoms, (b) a welding process, (c) a defective fuse, (d) the source of energy for hydrogen bombs.

_____3. A big problem for hibakusha (Japanese survivors) after their cities were destroyed by atomic bombs was the lack of (a) telephones, (b) doctors and medicine, (c) automobiles, (d) mail service.

_____4. Often when one superpower develops a new weapon system, the other superpower (a) does nothing, (b) blows it up, (c) works to get a similar or better system, (d) dismantles a system.

_____5. A conflict with a friend is often resolved differently from the same conflict with an enemy because of your (a) feelings about your opponent, (b) place of birth, (c) interest in having few friends, (d) none of the above.

6. A megaton equals ______________ tons of TNT.

7. The radioactive dirt and debris that falls back to earth after a nuclear bomb explosion is called ______________.

8. Two cities have been hit by nuclear weapons, Hiroshima and ______________.

9. When each side gives a little to reach an agreement, it is called ______________.

10. The point on the earth's surface on or above which a nuclear explosion occurs is called ______________.

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Worksheet 5-4

QUIZ

(Teacher's Copy)

Directions: For questions 1 through 5, choose the best answer and write its letter in the answer space.

For questions 6 through 10, fill in the blank to complete the sentence.

a 1. Radiation sickness is caused by (a) nuclear fallout, (b) electricity, (c) sitting too close to a radiator, (d) TV.

d 2. Fusion is (a) splitting of atoms, (b) a welding process, (c) a defective fuse, (d) the source of energy for hydrogen bombs.

b 3. A big problem for hibakusha (Japanese survivors) after their cities were destroyed by atomic bombs was the lack of (a) telephones, (b) doctors and medicine, (c) automobiles, (d) mail service.

c 4. Often when one superpower develops a new weapon system, the other superpower (a) does nothing, (b) blows it up, (c) works to get a similar or better system, (d) dismantles a system.

a 5. A conflict with a friend is often resolved differently from the same conflict with an enemy because of your (a) feelings about your opponent, (b) place of birth, (c) interest in having few friends, (d) none of the above.

6. A megaton equals *1,000,000* tons of TNT.

7. The radioactive dirt and debris that falls back to earth after a nuclear bomb explosion is called *fallout*.

8. Two cities have been hit by nuclear weapons, Hiroshima and *Nagasaki*.

9. When each side gives a little to reach an agreement, it is called *compromise or negotiation*.

10. The point on the earth's surface on or above which a nuclear explosion occurs is called *ground zero*.

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Lesson
6

WHAT IS NECESSARY FOR SECURITY?

LESSON CAPSULE:

Lesson 6 begins by eliciting student feelings about U.S.-USSR relations and ends by asking how the present military buildup meets U.S. domestic needs and national security goals.

Students share the letters they have written expressing their concerns about nuclear war. Students then play a decisionmaking game, standing beside different statements taped around the room that express their views about U.S.-USSR relations. This leads into an activity in which students express the fears that both Americans and Soviets have about the threat of nuclear war.

Students discuss the meaning of national security and read the U.S. goals for national security. They then discuss whether nuclear weapons help fulfill those goals. By creating a national budget, students examine the possible effects of future budgets on the quality of life in the United States. Students write in their journals for homework.

PURPOSES:

- To discuss issues of the needs for national security and the threat of Soviet aggression.
- To examine U.S. foreign policy and national security goals.
- To examine the effects of military spending on the U.S. economy and quality of life.

MATERIALS:

- The Purpose of National Security—Worksheet 6-1.
- United States National Budget—Worksheet 6-2.
- Proposed 1987 National Budget—Worksheet 6-3.
- 100 poker chips or tokens.
- Newsprint, magic marker, and tape.

DESCRIPTION OF LESSON:

A. *Letters.* Review the homework from Lesson 5. Ask several students to share the letters they wrote. You may choose to have students read each other's letters. After hearing several letters, discuss the following:
- What issues were most important to you?

If students wrote to the Soviet government, ask:
- If a Soviet youth your age were writing you a letter, what do you think she or he would say?

Collect the letters. For students who want to actually send their letters, you can either (1) find out the appropriate addresses, collect the letters and mail them or (2) tell students to find out the appropriate address and mail the letters themselves.

★B. *Decisionmaking on U.S.-USSR Relations.* Print each of the following decisionmaking statements on separate sheets of newsprint and tape on the walls around the room.

1. The Soviet Union is out to conquer the world.
2. The Soviet Union wants peace as much as the United States.
3. The United States should prevent the spread of Communism at all costs.
4. The Soviets and Americans should divide up the world.
5. Both the Soviets and the Americans should look after their own business and stay out of the affairs of every other country in the world.

Tell students to stand next to the statement they most agree with. After each group chooses a spokesperson, groups should spend five to ten minutes discussing why they chose that position. Then the spokespeople present each group's perspective. Allow students time to ask questions of each other and respond to others' positions.

Draw a line down the center of the chalkboard and write AMERICAN FEARS on one side and SOVIET FEARS on the other. Ask: "Why is the United States afraid of the Soviet Union?" Write the answers under the first heading. Then reverse the question: "Why is the Soviet Union afraid of the United States?" Write the answers under the second heading. (Examples of these fears could be fear of invasions, Communism or Democracy, nuclear attack, manipulating allies and controlling the world's resources.) Compare the two columns and discuss the following:

- Why is national security such an important issue for the two countries today?
- How do our fears and attitudes affect the foreign policy of the United States?

C. Ask students to define the purpose of national security. Write the answers on the board. Pass out Worksheet 6-1 (The Purpose of National Security). (The original text is in the Teacher Notes for this lesson.) Read the goals aloud and discuss the following:

- Why are these goals important?
- Is it important to help protect our allies and friends? Why or why not?
- Is it important to protect our borders? Why or why not?
- Is it important to protect our access to natural resources? Why or why not?
- Do nuclear weapons help ensure national security? Why or why not?
- What ways of ensuring national security do you think are most important?

★D. *The Military Budget and Its Effects.* Ask students to brainstorm a list of services that tax dollars pay for. The list can be put on the board and might include:

health care and hospitals
public transportation
parks
public schools
roads and highways
pension plans
social security
police
firefighters
military

Divide students into five groups. Hand out the blank budget sheet (Worksheet 6-2) to all students and 20 tokens to each group. Tell students that the budget sheet lists the various areas in which federal budget money is spent. The 20 tokens represent the total amount of money in the U.S. budget. Each group has to decide how many tokens should be spent for each category. They should divide up the tokens and then write their decisions next to each item on the budget sheet.

Write the categories from the budget sheet on the board. Have each group indicate the number of tokens they would spend on each category. Average the number of tokens in each category, write it down and circle it.

Pass out the Proposed 1987 National Budget (Worksheet 6-3). Tell students this represents the average figures of the proposed 1987 United States budget. Write on the board the number of tokens (dollar figures rounded off to fit the exercise) this budget allocates to each category. Circle these numbers and compare them with student figures. Discuss the following:

- Were the budget figures similar? If not, how were they different?
- How might the defense budget affect other budget decisions?

★E. *Homework.* Tell students that their homework assignment is to write their reactions, thoughts, and feelings of the day in their journals.

TEACHER NOTES:

THE PURPOSE OF NATIONAL SECURITY[14]

(A statement from the Executive Office of the President)

DEPARTMENT OF DEFENSE

The basic national security objective of the United States defense program is to prevent war—particularly nuclear war. The purpose of United States national security programs is to deter other nations from threatening our vital interests as well as those of our allies and friends. This deterrence must be based on the maintenance of strategic nuclear capabilities, which make nuclear war with us an unacceptable option; maritime superiority; a strong force posture in NATO and Northeast Asia; and the ability to deploy and sustain our forces worldwide.

National Needs Statement:

- Protect America's people, its institutions, and its lands from foreign aggression.

The Federal Role in Meeting the Need:

- Deter any attack upon, and prevent the coercion of, the United States, its allies, and friends.
- Protect U.S. economic interests and U.S. citizens abroad.
- Maintain access to critical resources.
- Maintain, in conjunction with our allies, the military capabilities required to counter the expansion of Soviet military presence, particularly where such expansion threatens the interests of the United States.

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[14] Excerpted from *Budget of the United States Government, Fiscal Year 1983*, Executive Office of the President—Office of Management and Budget (Washington, D.C.: Government Printing Office, 1982).

Worksheet 6-1

THE PURPOSE OF NATIONAL SECURITY[15]
(A statement from the Executive Office of the President)

The basic national security objective of the U.S. defense program is to prevent war—particularly nuclear war. The purpose of U.S. national security programs is to prevent other nations from threatening our natural resources and other interests as well as those of our allies and friends. To do this we must have nuclear weapons so that other countries realize that they cannot win a nuclear war with us. We need to have strong naval forces, a strong military presence in Europe and Northeast Asia; and the ability to send our forces worldwide.

NATIONAL NEEDS STATEMENT:

- Protect America's people, its government and society, and its lands from foreign forces.

THE FEDERAL ROLE IN MEETING THE NEED:

- Prevent any attack upon, and prevent the manipulation of, the United States, its allies, and friends.
- Protect U.S. resources, businesses, and citizens abroad.
- Maintain access to important resources.
- Continue to have, along with our allies, the military capabilities needed to stop the expansion of Soviet military forces, especially where this threatens the interests of the United States.

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[15] Paraphrased from *Budget of the United States Government, Fiscal Year 1983*, Executive Office of the President—Office of Management and Budget (Washington, D.C.: Government Printing Office, 1982).

Worksheet 6-2

UNITED STATES NATIONAL BUDGET

Listed below are six categories. The task of your group is to decide how much money to spend on each category. Your 20 tokens represent all of the money in the national budget. Distribute the 20 tokens among the six categories. Once you have made your decisions, write down the number of tokens you have given to each category.

CATEGORY *NUMBER OF TOKENS*

1. Social Needs:
    - Education
    - Food and nutrition
    - Job training
    - Social services
2. Social Security, Retirement, and Unemployment
3. National Defense
4. Physical Needs:
    - National resources and environment
    - Transportation
    - Housing
    - Community development
5. Health:
    - Medical research
    - Medical programs for the elderly, handicapped, and poor
6. Science and Politics:
    - Energy
    - Science
    - Agriculture
    - International affairs

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Worksheet 6–3

THE PROPOSED 1987 NATIONAL BUDGET

Listed below are the six categories you used to develop your national budget. The numbers that have been added represent the amount of money in the proposed 1987 national budget.[16] Compare these numbers with the ones you chose for your national budget.

CATEGORY	*NUMBER OF TOKENS*
1. Social Needs Education Food and nutrition Job training Social services	1
2. Social Security, Retirement, and Unemployment	6
3. National Defense	9
4. Physical Needs: Natural resources and environment Transportation Housing Community development	1
5. Health: Medical research Medical programs for the elderly, handicapped, and poor	2
6. Science and Politics: Energy Science Agriculture International affairs	1

(NOTE: Interest on the national debt and government administration costs are not included in this exercise.)

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[16] The actual figures for this exercise were obtained from *Budget of the United States Government, Fiscal Year 1983*, Executive Office of the President—Office of Management and Budget (Washington, D.C.: Government Printing Office, 1982).

Lesson
7

REDUCING THE RISK

LESSON CAPSULE:

Lesson 7 builds on knowledge from previous classes on conflict resolution and nuclear war issues. The lesson begins with the exploration of winning through cooperation and communication. The students then learn facts about the United States and the Soviet Union, the countries and people, land mass, population densities, and what the countries stand to lose in a nuclear conflict. Students begin to examine various options to reduce the risk of war by learning about possible national security policies.

Students then fill out a questionnaire about national security which they take home as an adult survey. They begin to study reasons why people hold different viewpoints. These activities are in preparation for Lesson 8, which deals with differing positions and the influence of the media on public opinion. An optional activity is to play the Oil Islands Dispute game, which simulates the struggle between two countries for the same ten islands on which there is oil.

PURPOSES:

- To learn that cooperation, especially in conjunction with communication, can benefit both sides in conflict.
- To explore some characteristics and security needs of the United States and the Soviet Union.
- To understand different means of averting nuclear war, including arms control and/or deterrence through military strength.
- To examine personal feelings about the arms race.

MATERIALS:

- Prepare for Cooperation Rectangles (see Activity A).
- Fact sheet on the United States and the Soviet Union—Worksheet 7-1.
- Fact sheet on National Security Options—Worksheet 7-2.
- Paper ballots.
- National Security Questionnaire—Worksheet 7-3—two copies per student.
- Red and blue poker chips (or colored paper squares, or coins, etc.) enough for two-thirds the class number—e.g., for a class of 30, you need 20 blue and 20 red chips.
- Prepare for Oil Islands Dispute game—Worksheet 7-4.

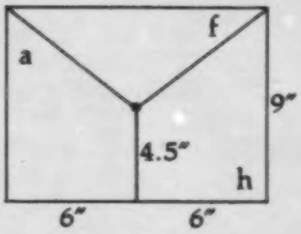
DESCRIPTION OF LESSON:

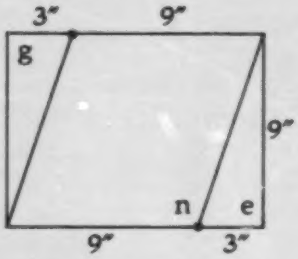
A. *Cooperation Rectangles. Before class,* prepare a set of five rectangles for each group of five students, using the diagrams below. Make each rectangle on construction paper or posterboard, using the measurements indicated. For each set, cut the five rectangles into their smaller pieces. Mix all the pieces together and then sort them into five piles. Be sure that no single pile contains an entire rectangle. Fasten each pile with a paper clip and place the set in an envelope.

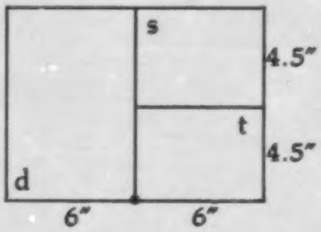
Divide the class into groups of five students and have each group sit at a table. Extra students can serve as silent observers to report the group process back to the class. Distribute an envelope with the clipped sets of rectangle pieces to each group. Tell students that when you give the signal, one member of each group will quietly distribute the clipped sets of rectangle pieces to the others in the group. Each group member should unclip his or her pieces and lay them down. Each group's task is to form five rectangles of the same size by redistributing the pieces. However, there are two rules to this game. Each group must work in silence, and no person can gesture to another to get or take a piece. Each person can only offer a piece to another. The other person can choose whether or not to accept the offered piece. The group's task is complete when members have formed five rectangles of equal size.

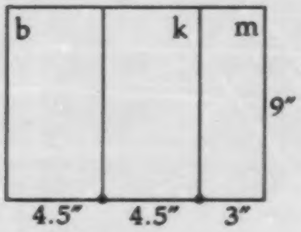
Remember: No member can speak, and no member may ask or signal that he or she wants a particular rectangular piece. Group members, however, may give pieces away.

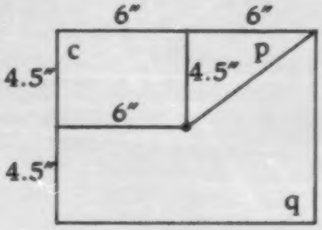
Note: The letters on the individual pieces allow you to reconstruct the rectangles when necessary. The pieces are not lettered in alphabetical order (for example, a, b, c and d=Rectangle 1) because this would provide a key for students.











B. *Dollar Game.* This game demonstrates that bargaining, compromise, and negotiation with "the other side" help everyone in the end. Two teams compete for the same goal—a $1 bill— and their tendency to try to outbid each other does not result in a gain.
Rules: Divide the class into two groups. Hold up a $1 bill and tell students you will give the dollar to the side that makes the highest bid. *Both sides* must give the money they bid to you regardless of whether they get the dollar bill. Flip a coin to see which side goes first.

After one side bids a few cents, the other side will bid higher. Both sides may bid until the amount reaches 99¢—and then they see their folly! After one side goes over 50¢, it may become apparent that *you* will gain at the next bid, since the sum of the two bids will be more than $1. One side may even begin to negotiate with the other at an earlier point.

Both sides can gain if they negotiate early so that each side bids less than 50¢. They split the dollar, and you lose. After playing the game, ask students:

- What were their immediate reactions to the bidding idea?
- At what point did they realize that bidding higher and higher was not working in their favor?
- Do people automatically compete?
- Does negotiation help each side win? If so, how?

★C. *National Security Options.* Divide students into groups of four to seven. Have students read the fact sheet on the United States and the Soviet Union (Worksheet 7-1) and answer the questions about what would be lost in the event of nuclear war. Then on Worksheet 7-2 have students rank order their preferences for national security options (see Teacher Notes).

★D. *National Security Questionnaire.* Have students fill out the questionnaire (Worksheet 7-3) in class.

★E. *Journal.* If you have elected to use the journal, have students make their entries.

★F. *Homework.* Students take home a copy of Worksheet 7-3 (National Security Questionnaire) for an adult to fill out. Tell students to inform the adult that the purpose is to compare answers between two different age groups.

G. *Optional Activity*

Oil Islands Dispute. Cut up and distribute Worksheet 7-4, giving each student $10 billion to start the game. Have students play the game in groups of three (see Teacher Notes).

TEACHER NOTES

National Security Options (Activity C). See the information from Union of Concerned Scientists and the Committee on the Present Danger (Appendix 2) for background information on security policies.

After students are in groups of four to seven, pass out both Worksheet 7-1 on the United States and the Soviet Union, and Worksheet 7-2 on national security options. Have students read and discuss the fact sheets about the two countries. Students should answer the questions on Worksheet 7-1 before rank ordering the national security options from most to least desirable (1 to 6). After 10 to 15 minutes, ask for group rankings with one or two advantages and one or two disadvantages. Tell students that they will be given the chance to vote for the policy of their choice after hearing arguments for each option. While each group spokesperson gives his or her presentation, it is important that other students not respond with judgments or criticisms, since this could affect the later presentations.

Students then vote with paper ballots and the votes are tallied. At this point the teacher should explain that many military experts believe that the U.S. and the Soviet Union may need to pursue several of these options in order to reach a new arms limitation agreement.

Ask students what keeps the United States and the Soviet Union from reaching agreement on mutually beneficial national security policies. They may mention distrust, suspicion, and ignorance. Discuss this activity in terms of what they have learned about the benefits of communication and cooperation.

Game Rules for Oil Islands Dispute (Optional Activity).[17] Divide the class into groups of three. One person represents the United States, one the Soviet Union, and the third is referee and scorekeeper. Read the following scenario and then explain the rules:

It is the year 2030 and vast oil deposits have been discovered on 10 islands in the Bering Straits between the United States and the Soviet Union. Neither country has ever pressed its claim to the islands although each has strong historical and legal reasons for doing so. Now, however, with a serious shortage of oil clearly ahead, both countries consider the islands extremely important.

During each round of this game (10 rounds total), the United States and the Soviet Union must decide to SEIZE or COOPERATE on an island. The two students each hold both a red and blue chip under the table. When the referee says "Go," both players quickly, and at the same time, display a chip that indicates their intention. The red chip will represent SEIZE and the blue chip COOPERATE. (Alternatively, a closed fist could represent SEIZE and an open palm could represent COOPERATE.)

If one player shows a red chip and the other a blue chip, the first (red chip) receives an oil island and gains $2 billion in profits; the second (blue chip) loses $1 billion. If both show blue chips, both cooperate, and gain $1 billion in profit and share the island. When both show the red chip, both seize; neither gets the island, and they lose $1 billion the first time, $2 billion the second time, and $3 billion the third time, (the third time both seize can represent nuclear war and both sides lose everything—both have scores of zero). Students keep track of gains and losses, and all groups give the teacher the scores at the end of 10 rounds.

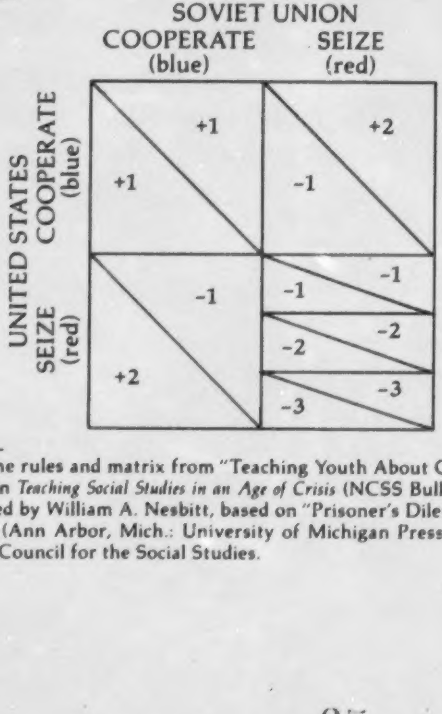
> Comments: A variation would be to play the game first in silence, then again allowing communication. Explain to students that people from different countries often do not speak the same language and cannot communicate verbally.

Students are strongly discouraged from continuing to seize. It can be pointed out that nuclear war declared by one superpower can become disastrous for both sides.

After the game, discuss the results with the students:

- Did escalation and the threat of nuclear war prevent them from seizing?
- Did communication (during the second round) encourage cooperation?
- Did efforts to seize the islands increase mistrust?
- Did any of the groups establish trust without communication?

The following matrix may help explain the possible combinations of SEIZING and COOPERATING:



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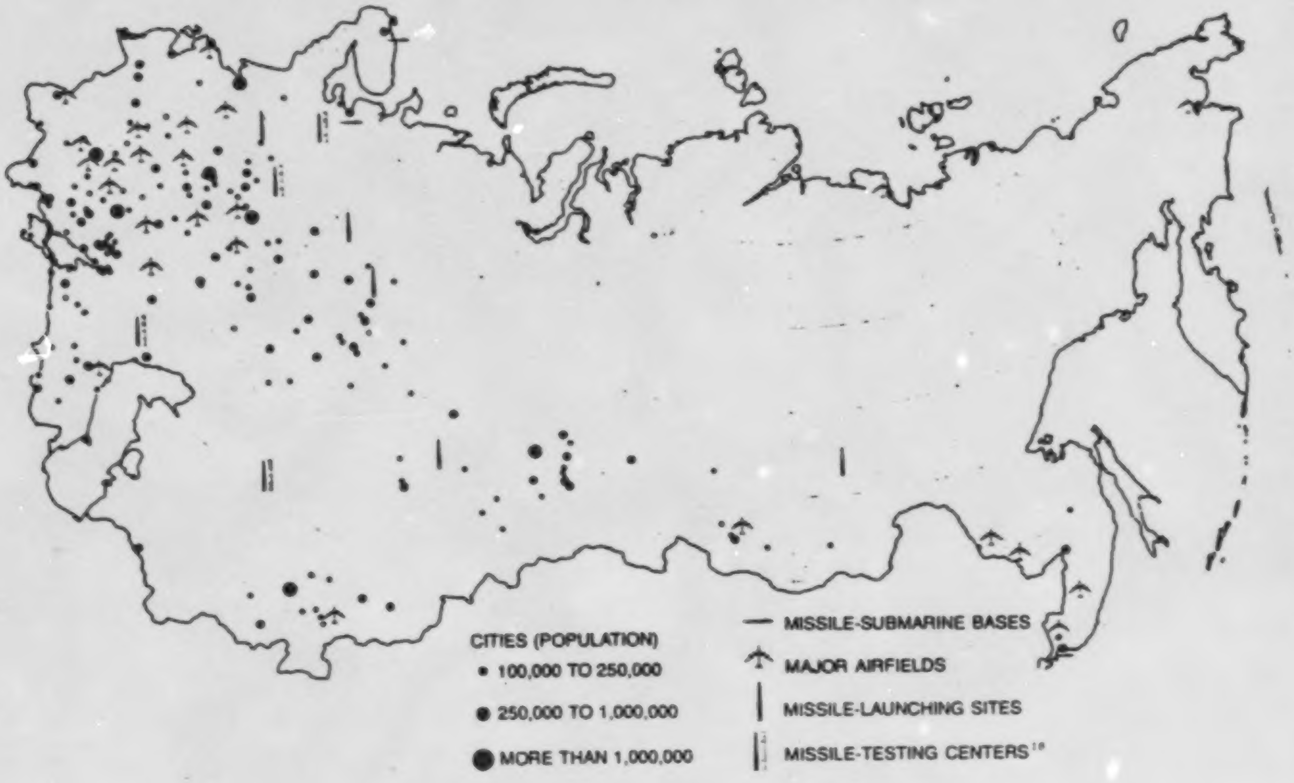
[17] Oil Islands Dispute game rules and matrix from "Teaching Youth About Conflict and War" by William A. Nesbitt and others, in *Teaching Social Studies in an Age of Crisis* (NCSS Bulletin No. 5, 1973, pp. 79-82). This game was developed by William A. Nesbitt, based on "Prisoner's Dilemma." See Anatol Rapoport, *Fights, Games and Debates* (Ann Arbor, Mich.: University of Michigan Press, 1960). Reprinted with permission of the National Council for the Social Studies.

Worksheet 7-1

U.S.-USSR FACT SHEET

The Soviet Union, or Union of Soviet Socialist Republics (USSR), is a country approximately 2½ times the size of the United States. It has 270 million people, mostly concentrated in the western portion of the country due to the harsh climate and living conditions elsewhere. The Soviet Union has large important reserves of minerals.

The Soviet Union is bordered by many countries, including some unfriendly countries and others that are part of the Warsaw Pact, which includes countries that are friendly to the Soviet Union. In the past, there have been as many as 1 million Chinese troops on the Soviet-Chinese border. The Soviet Union lost about 20 million people in World War II in addition to about 11 million in World War I and the Civil War of 1918. The country exploded its first nuclear weapon in 1949 and now has about 7,500 warheads targeted at the United States. About 75 percent of Soviet strategic weapons are on ICBMs. Another 20 percent are on submarines and 5 percent are on bombers.


CITIES (POPULATION)
• 100,000 TO 250,000
● 250,000 TO 1,000,000
⬤ MORE THAN 1,000,000
MISSILE-SUBMARINE BASES
MAJOR AIRFIELDS
MISSILE-LAUNCHING SITES
MISSILE-TESTING CENTERS[18]

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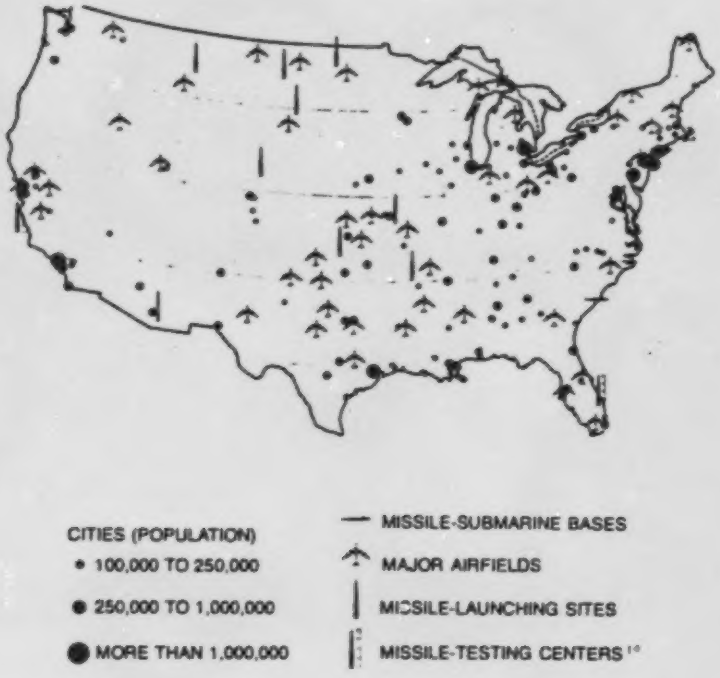
[18] From "The Prompt and Delayed Effects of Nuclear War" by Kevin N. Lewis. Copyright © 1979 by Scientific American, Inc. All rights reserved.

The United States is a country smaller in size than the Soviet Union. The United States has 230 million people, and its population is more dispersed, partially due to milder climate. The United States has a wealth of natural resources including rich farms, waterways, and minerals.

The United States is bordered on the north by Canada and on the south by Mexico, both friendly countries. The United States has lost over 1 million people in past wars including the Civil War, World Wars I and II, Korea, and Vietnam. However, no war has been fought in the United States since the Civil War. It exploded its first nuclear weapon in 1945. Less than a month later, it dropped atomic bombs on Hiroshima and Nagasaki. The United States has about 9,500 warheads targeted at the Soviet Union. About 25 percent of U.S. strategic weapons are on ICBMs. Another 50 percent are on submarines and 25 percent are on bombers.


CITIES (POPULATION)
• 100,000 TO 250,000
● 250,000 TO 1,000,000
● MORE THAN 1,000,000
MISSILE-SUBMARINE BASES
MAJOR AIRFIELDS
MISSILE-LAUNCHING SITES
MISSILE-TESTING CENTERS [10]

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[10] From "The Prompt and Delayed Effects of Nuclear War" by Kevin N. Lewis. Copyright © 1979 by Scientific American, Inc. All rights reserved.

After reading the fact sheet on the U.S.-USSR, answer the following:

1. How do the populations of the two countries compare in
   a. number?

   b. concentration or density of people (see dotted key below the maps)?

2. Compare the two countries in terms of the number and location of
   a. major airfields

   b. missile-launching sites.

3. Compare the two countries in terms of the number of people who died in past wars.

4. List three ways the United States could benefit from arms control agreements.

5. List three ways the Soviet Union could benefit from arms control agreements.

6. List three reasons why the continuation of an arms buildup could protect each country's interests.

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Worksheet 7-2

NATIONAL SECURITY OPTIONS

Below are six possible actions that the United States and the Soviet Union could take in order to either limit or continue the arms race. After reading the fact sheet and thinking about previous lessons, discuss with the group which option is in both countries' best interest and assign that choice a #1. Agree on the next one preferred (#2) and continue until the group ranks all six possible actions. For each action, decide upon its advantages and disadvantages. One person from your group will report your decisions back to the class.

Number *Advantages* *Disadvantages*

_____ COMPREHENSIVE TEST BAN TREATY

Consideration of a Comprehensive Test Ban Treaty began more than 20 years ago. The Comprehensive Test Ban Treaty would end, not just limit, all testing of nuclear weapons. It would also provide for possible on-site inspections in each country.

_____ BILATERAL DISARMAMENT

This would gradually reduce the number of weapons on each side until eventually *all* nuclear arms were eliminated.

_____ UNILATERAL DISARMAMENT

This involves one country announcing that it will reduce arms *regardless* of what the other does. The goal is to gradually reduce arms until there are no more.

_____ PEACE THROUGH STRENGTH

One country tries to convince another not to attack, threatening to do massive damage if it is attacked. Many supporters of "peace through strength" say the U.S. needs more weapons before it can choose this option.

_____ BILATERAL FREEZE

Each side would agree to halt the testing, production, and deployment (placement) of all new nuclear weapons and their delivery systems.

_____ NO FIRST USE

One country announces that it promises not to be the first to use nuclear weapons in the hope that the other country will agree to do the same.

_____ OTHER ________________________________

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Worksheet 7-3

NATIONAL SECURITY QUESTIONNAIRE

After each of the following statements, indicate whether you agree (A), disagree (D), or don't know (DK):

1. There can be no such thing as a "limited" nuclear war. A/D/DK
2. The world has too many nuclear weapons. A/D/DK
3. The United States and the Soviet Union can work together to stop the threat of nuclear war. A/D/DK
4. Conflict is a normal part of life. A/D/DK
5. Conflict always results in violent action. A/D/DK
6. War is sometimes necessary to settle disagreements. A/D/DK
7. The Soviets are more likely than the Americans to start a nuclear war. A/D/DK
8. The radio, TV, and newspapers always report what is really happening in the world. A/D/DK
9. The world is becoming more violent. A/D/DK
10. A single person can affect the course of the future. A/D/DK

If adults make comments on questions above, briefly state them below:

____

____

____

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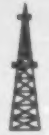
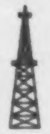
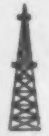
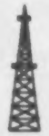
Worksheet 7-4

$1 Billion	$1 Billion	½ Island	½ Island	½ Island	½ Island
$1 Billion	$1 Billion	½ Island	½ Island	½ Island	½ Island
$1 Billion	$1 Billion	 ½ Island	 ½ Island	½ Island	½ Island
$1 Billion	$1 Billion	 ½ Island	½ Island	 ½ Island	½ Island
$1 Billion	$1 Billion	½ Island	½ Island	½ Island	½ Island

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Lesson
8

OPINIONS AND PERCEPTIONS OF WAR

LESSON CAPSULE:

In Lesson 8, students learn to develop their own opinions separate from the many influences in their lives.

The student questionnaire completed in Lesson 7 and the adult questionnaire completed as homework are tallied to find general opinions on conflict and war. They are then compared for similarities and differences. Students explore their sources of information about the world and try to decide which sources are factual and which emphasize opinion. Students learn to separate fact from opinion and discuss the concept of propaganda. Through the rumor game, students learn how facts may be distorted. The Who Said It? exercise demonstrates that people may be influenced as much by the person speaking as by the content of a statement.

Lastly, in the Optical Illusions exercise students learn that situations can be perceived in more than one way. They use this idea in completing the homework assignment.

PURPOSES:

- To compare adult and student opinions on conflict and nuclear war.
- To understand that an event, situation, or statement can be viewed in more than one way.
- To learn to separate fact from opinion.
- To explore how opinion or bias in the media can influence public opinion.
- To formulate opinions about the arms race.

MATERIALS:

- Fact/opinion articles and letter—Worksheets 8-1a, 8-1b, 8-1c.
- Kennedy and Hitler statements—Worksheet 8-2.
- Optical Illusions—Worksheet 8-3.
- Is This Fact or Opinion?—Worksheet 8-4.

DESCRIPTION OF LESSON:

★A. *Comparing Student and Adult Surveys.* Write the numbers 1 through 10 on the board. Have students take out their questionnaires completed the previous night. Also, pass out to each student the same questionnaire (which they took during the previous lesson). Tally the number of adults who agreed, disagreed or didn't know for each statement. Follow the same process to tally the student results. (If students are self-conscious about sharing the results of either questionnaire, have them pass in their papers and compile the results yourself.) Post the results on the board.

Review each statement and have students discuss the general opinion of adults on that statement. Ask students to share any other comments adults made during the interview. Discuss adults' general views about conflict and war as determined by the questionnaire. Follow the same process in examining student opinions of each statement. Discuss the following:

- Are there any differences between adult and student views on these issues? If so, what are they? Why do you think they exist?
- What are the similarities between adult and student views on these issues?
- What differences and similarities did you have with the adult you interviewed?

★B. *Where Do You Get Your Information?* Ask students to list where they get their information about the world (TV, radio, movies, magazines, newspapers, friends, parents, teachers, other adults).

Write FACT and OPINION on the board. Ask students what each word means. (*Fact:* something known as certain. *Opinion:* a belief based on knowledge, but not proven.)

Split the class into groups of four to six students. Each group should choose two sources of information that are more fact than opinion and two that are more opinion than fact. Each group should choose a recorder to write down the reasons for their choices. After 10 to 15 minutes, have the class reconvene and the recorder from each group present the group's conclusions. Discuss the following:

- Which sources were considered to be more factual?
- Do these sources always give out facts?
- Which sources seemed more oriented toward opinion?
- Why is it important to be able to tell the difference between fact and opinion?
- Do you believe everything you hear or read?

★C. *Separating Fact from Opinion. Prior to the class,* choose the letter or articles labeled Worksheet 8-1 for students to use in this activity based on reading ability, interest, and content. If none of the selections seems appropriate, you may select an alternate article from the newspaper.

Pass out Worksheet 8-1. Have students take out a blank sheet of paper and write two headings across the top, FACT and OPINION. Tell students to read the article and, afterward, to write down three facts and three opinions from the article.

Write two headings on the board, FACT and OPINION. Have students share the facts and opinions they found and write them on the board. Discuss the following:

- Why is it important when listening to TV or reading a newspaper to know what is fact and what is opinion?
- How do you decide what is fact and what is opinion?
- Why is it important to develop your opinions from fact rather than someone else's opinion?
- Is it OK if your opinion differs from someone else's? Why or why not?

Write the word PROPAGANDA on the board. Ask students if they know the meaning. (*American Heritage Dictionary* definition: all words and actions that express an opinion in the form of fact.) Write students' definitions under the word on the board. Discuss the following:

- How does propaganda influence us?
- How can opinions be used as propaganda?
- How might propaganda prevent the United States and the Soviet Union from peacefully solving their problem?

D. *The Rumor Game.* Divide students into two groups and place both groups at one end of the room at points C and D (see diagram below). Ask for a volunteer from each group. Have the two volunteers go to the other side of the room. Quietly read them the Rumor Game statement given in the Teacher Notes for this lesson. Tell them they have to tell the statement as accurately as possible to someone else in their group. The students should stand at points A and B, call someone from their group to come over, and quietly tell that person the statement. The first student from each group should sit down at points A and B, and the second student from each group should call over another member of his/her group. Continue until the last member of each group has heard the story. Both of the final students should say what they heard. (You may wish to have one of these students leave the room while the other gives his or her version of the story.) Now read the original statement, and discuss the following:

- How did the statement change?
- If someone believed what the last person said after hearing it, how far from the truth would she/he be?
- How could this process create misunderstandings between the United States and the Soviet Union?

E. *Who Said It?* Cut copies of the Kennedy and Hitler statements (Worksheet 8-2) in half. Give the top half to one side of the class and the bottom half to the other side. Have students silently read the statement and think about it. (This is actually a fictitious statement.) Then ask how many students agreed with the statement. Tell everyone that it was written by neither person. Discuss the following:

- How does knowing who said something influence how it is interpreted?
- Why is it important to evaluate the meaning of something apart from who said it?

F. *Perceiving Different Images.* Pass out the Optical Illusions (Worksheet 8-3). Have students look at each figure and tell you what they see. If they haven't yet seen that there are two ways of looking at each picture, have them go back and look for a second image: Figure A, a goblet and two faces; Figure B, the face of a young woman and the face of an old woman.

Tell students that many times when people look at things, they see what is most pleasing to them, or what they are most used to. People don't usually discover more than one way of looking at things. Discuss the following:

- When reading or hearing about something concerning the world, why is it important to think of more than one way of looking at a situation?

★G. *Journal.* If you have elected to use the journal, remind students to make their entries.

H. *Homework.* Hand out Worksheet 8-4 (Is This Fact or Opinion?). Ask students to complete it for homework, based on the day's discussion.

TEACHER NOTES:

Rumor Game Statement. Read this statement to the first person in each group. Read it aloud to the entire class after the final student in each group has stated what she or he heard.

> Alice likes John. But John has been going out with Sue for several months. John likes Alice also, but isn't sure what to do.
>
> —fictitious statement

Worksheet 8–1a

Reagan: 'right time' for right missile'[20]

By Curtis Wilkie, Globe Staff

WASHINGTON—President Ronald Reagan announced yesterday a plan to deploy the MX missile force in a tight cluster of silos near Cheyenne, Wyo. The decision was coordinated with a televised address by Reagan last night in which he said the US military buildup was necessary as part of a "strategy for peace."

"It is sadly ironic that in these modern times it still takes weapons to prevent war," Reagan said. "I wish it did not." Contending that "one-sided arms control doesn't work," Reagan added, "We have tried time and again to set an example by cutting our own forces in the hope that the Soviets will do likewise. The result has been that they keep building."

To counteract the Soviet threat, he said, "We will modernize our military in order to keep the balance for peace."

Even as he announced plans to modernize the US strategic nuclear force, Reagan said he was pursuing improved relations with the Soviet Union and still hoped eventually to obtain an agreement with Moscow to reduce the arsenals on both sides.

He made it clear that his chief initiative will be a move to place 100 MX missiles in "superhard" silos—a basing mode recommended by the Defense Department and known as "dense pack."

In connection with the theme that the new intercontinental ballistic missile is essential to deter the Soviet Union from launching an attack, Reagan said he was naming the MX "Peacekeeper."

The program would cost about $26 billion, Reagan said. If Congress approves funds quickly, the system could be operational by late 1986.

Aware of opposition to the proposal, the President appealed, in a letter released by the White House, to members of Congress to "keep an open mind on this complex and important question and permit the Administration to make its case for the decision."

Before making his speech, Reagan met with a bipartisan congressional delegation to make a personal plea on behalf of the program, but there were indications that he faces a difficult struggle to win funds for the MX.

Reagan said that he settled on the proposal to concentrate the missiles at the Francis E. Warren Air Force Base near Cheyenne after weighing a wide range of options. He said cost was a consideration.

A plan by the Carter Administration to scatter missiles through several Western states was abandoned by Reagan a year ago. "Not only was the financial cost high—$40 to $50 billion," Reagan said in a formal statement announcing his decision, "but the cost of our Western citizens in terms of water, land, social disruption, and environmental damage seemed unreasonable."...

"We concluded that by pulling the launch sites much closer together and making them a great deal harder, we could make significant savings," Reagan said. "We would need fewer silos, much less land, and, in fact, fewer missiles." The President did not mention it, but Wyoming was more receptive toward serving as the base for the missiles than the other states.

Under the "dense pack" theory, Reagan said, "we would achieve a system that could survive against the current and projected Soviet rocket inventory. Deployment of such a system would require the Soviets to make costly new technical developments if they wish to even contemplate a surprise attack."

He said the system would be designed to provide for additional silos "if the Soviets will not agree to strategic arms reductions."...

"The Soviet military buildup must not be ignored," he said. "If my defense proposals are passed, it will still take five years before we come close to the Soviet level."

"Unless we demonstrate the will to rebuild our strength and restore the military balance, the Soviets, since they are so far ahead, have little incentive to negotiate with us," Reagan said.

The President promised to continue efforts to eliminate all intermediate-range nuclear missiles, a policy he announced almost exactly a year ago in a speech in which he called upon the Soviets to dismantle their SS20 missiles in Eastern Europe in exchange for an American agreement not to deploy an equivalent missile in Europe.

"The Soviet Union has thus far shown little inclination to take this major step," Reagan said.

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[20] Excerpted from *The Boston Globe*, November 23, 1982. Reprinted with permission.

Worksheet 8-1b

THE MUSHROOM CLOUD LURKING IN OUR MINDS[21]

Once again we paid homage to these, the grimmest of our anniversaries. Aug. 6, the bombing of Hiroshima. Aug. 9, the bombing of Nagasaki.

By now, there has grown a kind of ritual to these anniversaries. We round up the usual survivors, the usual statistics, the usual sentiments.

We remind ourselves annually that those two "primitive" nuclear bombs killed 200,000 people immediately, and 130,000 people slowly.

We have on hand for these occasions a ready supply of powerful quotes about nuclear bombs. Which one did you hear this year? Einstein, Eisenhower, or perhaps this one from Churchill: "The Stone Age may return on the gleaming wings of Science and . . . may even bring about its total destruction. Beware, I say: Time may be short. . ."

Still, this is always a curious anniversary. It's less of a memorial to the pain of the past than a homage to the anxiety of the present.

This past week we commemorated 37 years of life with the bomb. In this time we have built enough weapons between us, the United States and USSR, to destroy a million Hiroshimas. Two generations of us have grown up with the sense of their future hanging by a hair trigger.

The war babies, the postwar babies were the first whose childhood nightmares took mushroom shapes. Our monster was one that we couldn't escape. Despite the school drills, all the civil-defense follies of the fifties, we knew that it would be impossible to duck the bomb.

The bomb has hung over us like some apocalypse without the promise of redemption. It's hard to calculate just how completely the bomb has permeated our daily lives. I don't know whether the existence of this doomsday weapon paralyzed us or catalyzed us, made us feel hopelessness or an urgency. But even during the decades of denial, it hovered at the edge of our consciousness.

One teenaged summer night, I lay in the dark and played out a fantasy with a friend: What would you do if you knew, you absolutely knew, the bomb would be dropped in a year? How many of our actual adult decisions are still made in that mode?

Last summer, on the 36th anniversary, I had a similar conversation with Dr. Helen Caldicott, who has been a leader in this antinuclear awakening. How do we live with this bomb? Do we live as if the end were inevitable, and opt for the private pleasures of life? Do we live as if change were possible? Do we live as if we can plan for our old age?

These questions have all seemed more intense this year, when our government began to talk in a mad patois about winnable wars and survivable wars. As the President ordered the making of 17,000 more bombs and reassured us with bizarre plans for civil defense, the country began to talk again about the unthinkable.

In the midst of this, a teenaged friend rephrased my own childhood questions. Matter-of-factly she said that if she knew there was going to be a nuclear war she wouldn't make plans toward medical school. Medical school, you see, took so long, was such hard work.

I reminded her about all the people who had made their lives since the bomb was invented. We don't stop, don't wrap ourselves in mourning sheets and wait for the end. We proceed, have to proceed, as if there is sense to it.

Yet I have often wondered how much of the postwar unwillingness to delay gratification, to postpone pleasure, to sacrifice for the next generation came from the sense that we are living, literally, on a dead line.

We may not overtly think about the bomb when we invest in an IRA, sign a 25-year mortgage, plan a pregnancy. But it sits there mocking us from our subconscious.

I know that humans have always lived with fear of the future. Over centuries, religious zealots have regularly been sure that Armageddon was around the corner. Over centuries, ordinary people have had fears of plague and childbirth and wars. We are hardly the first generation to ask how would I live if I knew precisely when I would die?

Yet this is different. We are not talking about death but extinction. Not talking about our future, but about any future. This was, once again, the ominous background hum, the theme song for the anniversary of such an incompatible couple: the human being and the nuclear bomb.

Ellen Goodman is a Globe *columnist.*

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[21] Reprinted from *The Boston Globe,* August 10, 1982, with permission of the Washington Post Writers Group.

Worksheet 8–1c

JUNIOR HIGH SCHOOL LETTER

Hi Terry,

Did you hear about Billy and Louis? They are 8th grade students at my school. Billy is a nicer person than Louis. They eat during the same lunch period.

Louis gets good grades but you can't trust him. I heard that Billy doesn't like Louis. Billy has a girlfriend named Debbie. I saw Louis talking to a girl during activity period. I think it was Debbie. I'm going to tell Billy that Louis is moving in on his girlfriend.

See ya,
Pat

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Worksheet 8-2

KENNEDY AND HITLER

"There's too much crime being committed in our society today. The justice system is much too easy on lawbreakers, and many times favors the criminal, not the victim. We have to provide more protection and create tougher laws to ensure the safety of our citizens."

—John F. Kennedy

"There's too much crime being committed in our society today. The justice system is much too easy on lawbreakers, and many times favors the criminal, not the victim. We have to provide more protection and create tougher laws to ensure the safety of our citizens."

—Adolf Hitler

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Worksheet 8–3

OPTICAL ILLUSIONS[22]

Figure A

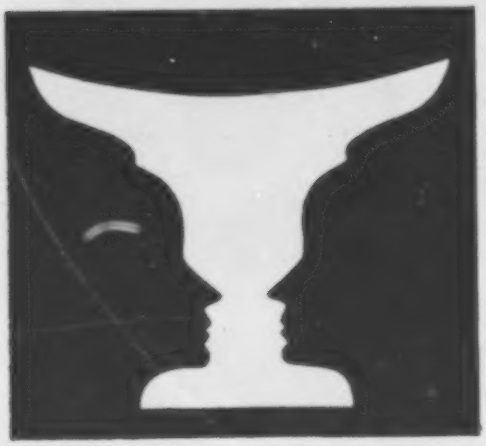
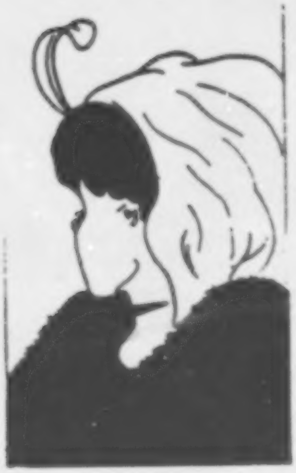


Figure B



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[22] Drawings from "The Wife and the Mother-in-law" in *Fundamentals of Social Psychology* by Eugene L. Hartley and Ruth E. Hartley (New York: Knopf).

Worksheet 8-4

IS THIS FACT OR OPINION?

Answer the following questions using the information we discussed in class today. You may use the discussion or any worksheets from today's lesson.

1. List three facts about nuclear weapons.
   a.
   b.
   c.

2. List three opinions about nuclear weapons.
   a.
   b.
   c.

3. Is it possible to have different opinions from the ones you wrote above? Why or why not?

4. Pick one of the opinions about nuclear weapons (from #2) and write three facts to support the opinion.
   a.
   b.
   c.

5. Why is it important to base your opinions on fact?

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Lesson
9

A BETTER WORLD

LESSON CAPSULE:

> THE STARTING POINT for a better world is the belief that it is possible. Civilization begins in the imagination. The wild dream is the first step to reality. It is the direction-finder by which people locate higher goals and discern their highest selves.[23]
>
> Norman Cousins

This lesson suggests the vision of a better world through creative imagination. Students will select one of five diagrams that they think best describes their view of the world today. The words and music of a song of your choice may be used to provide the background music and inspiration for the construction of student projects. These projects will present student visions of how they would like the world to be in the future. Individual projects may take any form the student chooses: story, painting, collage, mobile, song, skit, etc. This lesson is the "dream," the first step toward the reality of a better world. It provides the imaginative force leading to the action of Lesson 10.

PURPOSES:

- To have students reflect on their view of the U.S. relationship to the world today.
- To encourage the use of imagination as a tool for creating future options.
- To begin to examine actions that might lead to the futures that students envision.

MATERIALS:

- Dots handout—Worksheet 9-1.
- Optional background music.
- Art materials: paints, craypas, collage material, scissors, glue, paper, etc.

DESCRIPTION OF LESSON:

A. *Homework.* Review lesson 8's homework with students.

★B. *U.S.-World Relationship Today.*
  1. Provide the class with five dot drawings in one of two ways:
    a. Draw the diagrams on the board.
    b. Distribute the "dots" handout (Worksheet 9-1) to each student.[24]

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[23] Cousins, Norman. *Human Options.* New York: Norton, 1981.

[24] Diagrams from Gallagher, Mary Beth, and others. *Educating for Peace and Justice: A Manual for Teachers.* 5th ed. (p. 189). St. Louis: Institute for Education in Peace and Justice, 1976. (1981 edition available.)

2. Ask students to visualize the relationship between the United States and the rest of the world. Have them select the dot drawing that best expresses their view of this relationship and label the dot which they think represents the United States. Students may draw a dot picture different from the five given if they prefer.
3. After students have chosen their pictures, ask a volunteer to explain his/her view of the U.S.-world relationship as well as the reason she/he chose a particular dot picture.
4. Count and record the number of students who also chose this picture. Ask several other students to explain why they chose the same drawing.
5. Tally the number of students choosing each dot drawing. Elicit reasons for choosing each of the five drawings. The following descriptions may be helpful in understanding the pictures:
   a. Polarity; complete division
   b. Separate groups with a few people in communication
   c. Everyone together
   d. Everyone equidistant—conformity
   e. Group that hangs together but with a number of people on the margin.[25]
6. After concluding the discussion of the current U.S.-world relationship, have students choose the picture that describes their hope for the U.S.-world relationship in the year 2080 A.D.

C. *Class Atmosphere.* Have students listen to some music which encourages creativity. The selections that follow or another of your choice might provide background music for the subsequent art project:

"Imagine" by John Lennon
"I Want to Live" by John Denver
"Ain't Gonna Study War No More" by Pete Seeger
"There's a Place for Us" from *West Side Story.*

★D. *2080 A.D.* This activity encourages students to create and consider options for the future. Emphasis should be on the idea that a better world begins with the belief that it is possible.

1. Ask students to create their vision of how they *would like the world to be* in the year 2080 A.D. They may use any artistic expression they wish: story, painting, collage, mobile, song, skit, etc.
2. Ask students to comment on their vision of how the world *will be* in the year 2080 A.D. Are the two images different? Why?
3. You may wish to adjust the year 2080 A.D. to the phrase "20 years from now," or "when you are 60 years old." Some students may have difficulty envisioning the world so far into the future.

★E. *Journal.* If you have elected to use the journal, remind students to make their entries.

★F. *Homework.* (Individuals Count). This homework prepares students for Lesson 10. Students consider what actions they could take to make the world a better place. Have students make a list of three to five things in each of these categories:

1. Things I Could Do Now to Make My Everyday Life Better
2. Things I Could Do Now to Make the World Better
3. Things I Could Do When I'm Older to Make the World Better.

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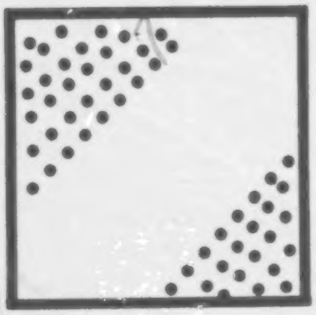
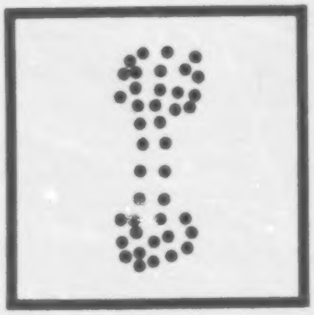
[25] *Ibid.*

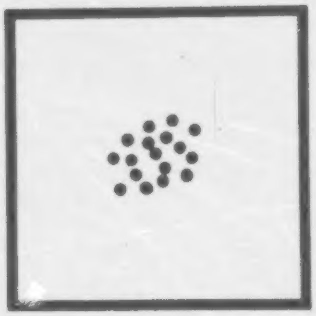
Worksheet 9-1

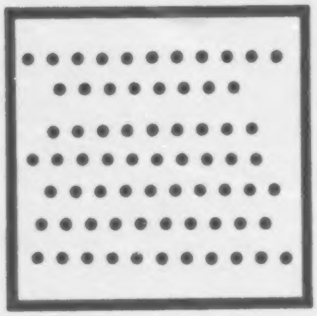
DOTS[26]

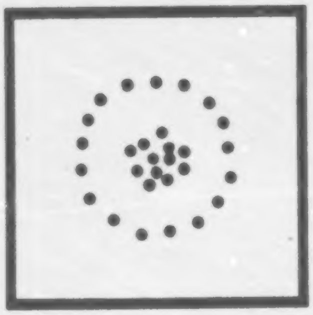
Choose the picture that best describes your view of the relationship between the United States and the world today. Label the dot which represents the United States in the picture you choose. You may draw a dot picture different from the five given if you prefer.











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[26] From *Educating for Peace and Justice: A Manual for Teachers*, 5th ed., p. 189, by Mary Beth Gallagher and others (St. Louis: Institute for Education in Peace and Justice, 1976). Reprinted with permission of Institute for Peace and Justice.

Lesson
10
CHOICES

LESSON CAPSULE:

The final day of the unit will give students time to reflect on the unit and consider ideas for action. At the beginning, you should remind students of the story of *The Hundredth Monkey* and the power of the individual to make a difference, especially when joined with others in group action. Imagining what a better world could look like (Lesson 9) can also be productive in encouraging students to act on their beliefs.

We hope this unit will have a lasting impression on students. Students should be encouraged to express their feelings in a healthy way by continuing to discuss the issues of nuclear war and conflicts and by incorporating their awareness in action.

Students will suggest different ways they can educate themselves and others. Activities and projects within the classroom and school are suggested to supplement their ideas. Encourage students to make realistic and appropriate suggestions (see Teacher Notes), recognizing the climate of the school and community.

A few suggested projects may involve the entire school and require the approval of school administrators. One possibility is to present sympathetic administrators with project ideas and to solicit their reactions. It is important to gain such support before publicizing an event.

Students should be given a few minutes to retake the student survey from Lesson 1, including time to compare and discuss the differences in their responses. Students should also be encouraged to express their feelings about the unit in general.

PURPOSES:

- To work together at brainstorming activities for taking action within the classroom and school.
- To embark upon a class or group project that will allow students to act on their knowledge and feelings.
- To reflect on the unit and evaluate it.

MATERIALS:

- Final quiz—Worksheet 10-1 (optional).
- Student surveys (see Lesson 1, Worksheet 1-1).
- Eisenhower sheet—Worksheet 10-2.

DESCRIPTION OF LESSON:

★A. *Homework from Lesson 9.* Write on the board: *Everyday, World, When I'm Older.* Ask students for ideas in each category.

★B. *Activities and Projects.* Have students work in small groups (four to seven) to suggest projects they can realistically accomplish within the classroom or school that will incorporate their new knowledge. (See Teacher Notes for suggestions.)

After 15 minutes, have a spokesperson from each group present the group's ideas to be written on the board or on newsprint. Ask students which projects, if any, they would like to do.

Optional: Have students work in small groups and decide on actions they can take outside school, on the following levels of involvement:

COMMUNITY STATE LEGISLATURE FEDERAL GOVERNMENT WORLD

★C. *Journal.* Students should now pass in their journals for display or optional grading.

D. *Optional*

1. Have students take the final quiz (Worksheet 10-1). Add your own short-answer, vocabulary, or essay questions based on what was emphasized in your class.
2. Have students do a "whip" completing the statements:

   From this unit, I enjoyed . . .
   I learned . . .
   I didn't like . . .
   I recommend . . .

   Give students a few minutes to reflect on the unit. In turn, they complete the statements, or they may choose to pass.
3. Have students list ways their feelings or ideas changed during this unit.
4. Have students read the Eisenhower quotes—Worksheet 10-2—answer the questions and express their feelings.
5. Have students write an essay on their feelings about the unit.

TEACHER NOTES:

The following are suggested student activities.

School

- Teach younger children within the school topics learned in this unit.
- Do a videotape on the unit and play for the school.
- Form student study groups on issues of nuclear war and its prevention. Continue to bring in clippings for the bulletin board and share information with friends.
- Have a poster display in the hall; have a poster contest.
- Have an awareness day at school. Pass out leaflets, pictures, poems, or essays on nuclear war.
- Write and perform a skit for the class or a school talent show.
- Organize an assembly on important issues pertaining to this unit. Order a film (see Appendix 1) or ask someone from the community to come to speak.
- Write an article or editorial for the school newspaper.
- With the help of students, faculty, and school support staff, list concerns about the arms race. Have each person sign the list and mail it to state and federal policy-makers.
- Design a logo or pattern for a T-shirt. Work with the art department to have them silkscreened. If the class sells the shirts, send the extra money to an organization in the community that the class wants to support.

- Take out an ad in the school newspaper with a list of concerns.
- Encourage teachers in other classes to spend a class period discussing nuclear war issues.
- Have students organize events, such as poster displays, skits, or cassettes, for a school open house.

Community

- Organize a "fair" with booths, films, speakers, and music.
- Write a letter, editorial, or article for the city newspaper. Call a local reporter and tell him/her what the class is doing.
- Contact the local radio and TV news and ask to present a one-minute summary of class opinions on nuclear weapons or nuclear war.
- Set up a literature table at a community event such as a flea market or block party.
- Contact the PTA and make the class's concerns known. Go to a PTA meeting prepared to speak for three minutes on issues of concern.
- Find out the role the military plays in the community. Are weapons produced at a local plant (see the map which follows)? Is research and development in progress at a local university? Are weapons stored at a nearby base? Write an article containing these facts for the local newspaper.
- Call or write your state legislators. Find out their positions on arms limitation and peace through strength. Write back expressing your views.
- Collect signatures to place a referendum question on a nuclear issue on the ballot.
- Contact the state Department of Education and find out which schools have courses on nuclear war.

Federal

- Write the White House and tell the president of your concerns.
- Send a telegram or mailgram to the president or your representative in Congress (telegrams cost about $3.00 for 15 words).
- Write your representatives and senators, and ask their views on nuclear war, national defense, and potential arms agreements such as SALT, START, Freeze, and No First Use. After you receive their letters, write back explaining how you agree or disgree with their views.
- Read articles or congressional hearings on civil defense (available from community groups or the library). Write your views in response.

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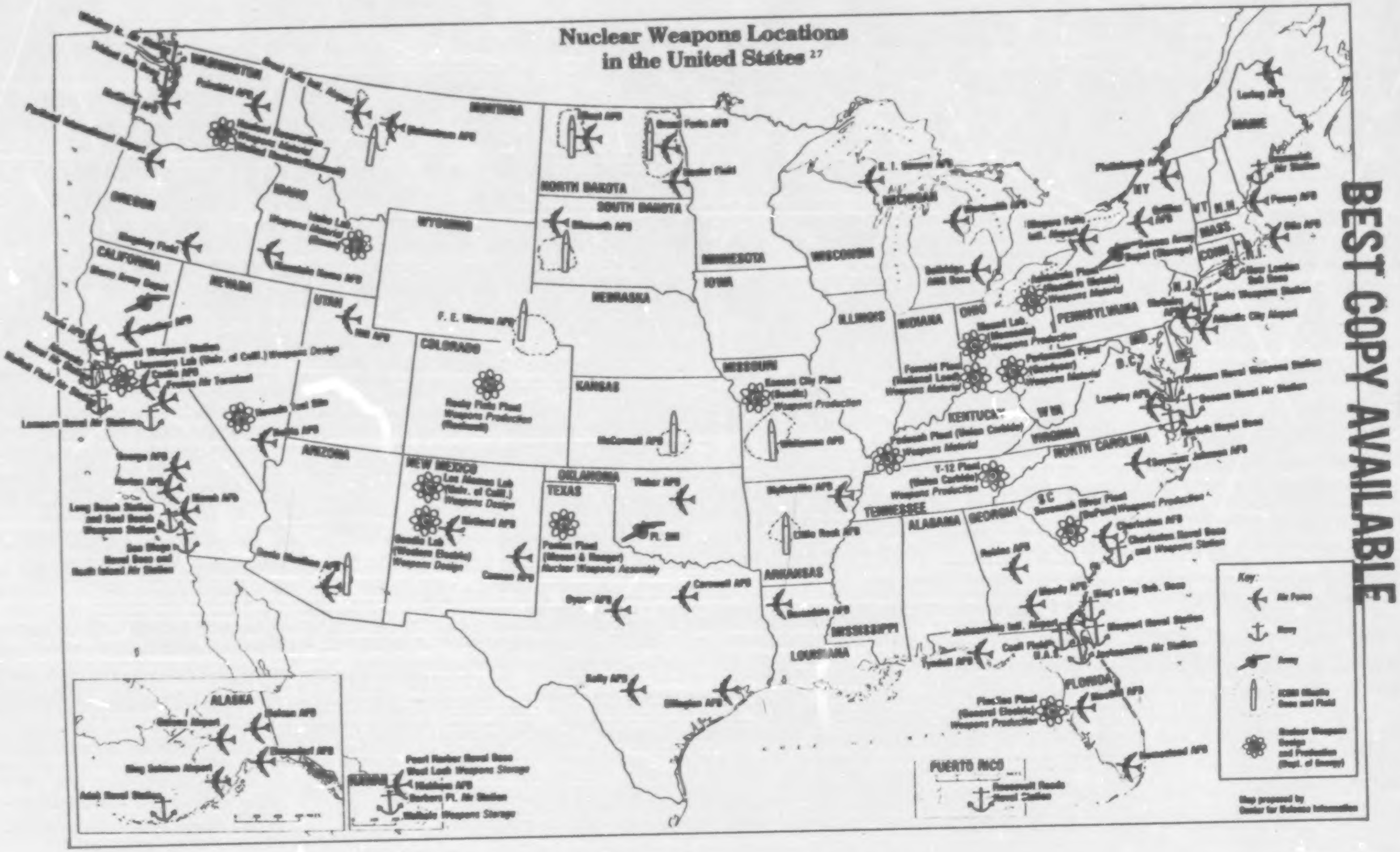
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Rocky Flats Plant Weapons Production (Rockwell)
Los Alamos Lab (Univ. of Calif.) Weapons Design
Sandia Lab (Western Electric) Weapons Design
Kirtland AFB
Pantex Plant (Mason & Hanger) Nuclear Weapons Assembly
Kansas City Plant (Bendix) Weapons Production
Whiteman AFB
McConnell AFB
Little Rock AFB
Blytheville AFB
Paducah Plant (Union Carbide) Weapons Material
Y-12 Plant (Union Carbide) Weapons Production
Savannah River Plant (DuPont) Weapons Production
Pinellas Plant (General Electric) Weapons Production
Mound Lab (Monsanto) Weapons Production
Fernald Plant (National Lead) Weapons Material
Portsmouth Plant (Goodyear) Weapons Material
Nevada Test Site
Livermore Lab (Univ. of Calif.) Weapons Design
Lemoore Naval Air Station
Ellsworth AFB
Minot AFB
Grand Forks AFB
Malmstrom AFB
Fairchild AFB
Mountain Home AFB
Hill AFB
Davis Monthan AFB
Barksdale AFB
Carswell AFB
Dyess AFB
Tinker AFB
Ft. Sill
Kelly AFB
Ellington AFB
Seymour Johnson AFB
Charleston AFB
Charleston Naval Base and Weapons Station
Kings Bay Sub. Base
Mayport Naval Station
Jacksonville Air Station
Homestead AFB
Langley AFB
Norfolk Naval Base
Yorktown Naval Weapons Station
Atlantic City Airport
New London Sub. Base
Earle Weapons Station
Pease AFB
Otis AFB
Loring AFB
Brunswick Air Station
Plattsburgh AFB
Griffiss AFB
Wurtsmith AFB
K. I. Sawyer AFB
Selfridge ANG Base
Roosevelt Roads Naval Station
Pearl Harbor Naval Base
West Loch Weapons Storage
Hickam AFB
Barbers Pt. Air Station
Wahiawa Weapons Storage
Eielson AFB
Elmendorf AFB
Galena Airport
King Salmon Airport
Adak Naval Station
Key:
Air Force
Navy
Army
ICBM Missile Base and Field
Nuclear Weapons Design and Production (Dept. of Energy)
Map prepared by Center for Defense Information

Nuclear Weapons Locations in the United States[27]

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[27] From "Preparing for Nuclear War: President Reagan's Program." *Defense Monitor* 10, no. 8, 1982. Reprinted with permission of Center for Defense Information.

Worksheet 10-1

FINAL QUIZ

Directions: For questions 1 through 12, choose the best answer and write its letter in the answer space.

For questions 13 through 20, indicate whether the statement is true or false.

_____ 1. Hiroshima is (a) a city in Japan, (b) the name of the hundredth monkey, (c) eaten with chopsticks, (d) a city in China.

_____ 2. The first atomic bomb was dropped in (a) 1925, (b) 1935, (c) 1945, (d) 1955.

_____ 3. A person who helps settle an argument is known as a (a) warhead, (b) egghead, (c) escalator, (d) negotiator.

_____ 4. An MX missile is about as powerful as how many Hiroshima bombs? (a) 50, (b) 100, (c) 200, (d) 250.

_____ 5. Invisible, harmful leftovers from a nuclear explosion are known as (a) fusion, (b) radioactivity, (c) fission, (d) escalation.

_____ 6. The U.S. government spends more of its budget on (a) military programs, (b) social programs, (c) foreign aid, (d) environment.

_____ 7. How many strategic nuclear weapons do the United States and the Soviet Union possess? (a) 2,000, (b) 4,000 (c) 8,000, (d) 17,000.

_____ 8. When one or more nations announce plans to stop testing or developing new weapons, this policy is called (a) freeze, (b) no first use, (c) an arms race, (d) fallout.

_____ 9. When one nation announces that it will reduce its weapons regardless of what another does, this policy is called (a) a test ban, (b) a freeze, (c) bilateral disarmament, (d) unilateral disarmament.

_____10. Hibakusha is the name for (a) a city in the Soviet Union, (b) Japanese survivors, (c) the atomic bomb dropped on Japan, (d) the hundredth monkey.

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_____11. *The Hundredth Monkey* is really a story about (a) sweet potatoes, (b) the ability of the individual to make a difference, (c) creation, (d) 10 different ways to compromise.

_____12. Putting dangerous bacteria in the air or water supply is an example of (a) chemical warfare, (b) a type of new warhead, (c) biological warfare, (d) peaceful negotiation.

The following are either true (T) or false (F):

_____13. Half the people in the world live in the United States or the Soviet Union.

_____14. Conflict resolution is settling disputes.

_____15. The United States is larger in size than the Soviet Union.

_____16. An opinion is always the truth.

_____17. Fission is the splitting of atoms.

_____18. Fallout is a measure of energy in a nuclear weapon.

_____19. A bomb is a weapon.

_____20. Conflict is not always bad.

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Worksheet 10-1

FINAL QUIZ

(Teacher's Copy)

Directions: For questions 1 through 12, choose the best answer and write its letter in the answer space.

For questions 13 through 20, indicate whether the statement is true or false.

a 1. Hiroshima is (a) a city in Japan, (b) the name of the hundredth monkey, (c) eaten with chopsticks, (d) a city in China.

c 2. The first atomic bomb was dropped in (a) 1925, (b) 1935, (c) 1945, (d) 1955.

d 3. A person who helps settle an argument is known as a (a) warhead, (b) egghead, (c) escalator, (d) negotiator.

d 4. An MX missile is about as powerful as how many Hiroshima bombs? (a) 50, (b) 100, (c) 200, (d) 250.

b 5. Invisible, harmful leftovers from a nuclear explosion are known as (a) fusion, (b) radioactivity, (c) fission, (d) escalation.

a 6. The U.S. government spends more of its budget on (a) military programs, (b) social programs, (c) foreign aid, (d) environment.

d 7. How many strategic nuclear weapons do the United States and the Soviet Union possess? (a) 2,000, (b) 4,000 (c) 8,000, (d) 17,000.

a 8. When one or more nations announce plans to stop testing or developing new weapons, this policy is called (a) freeze, (b) no first use, (c) an arms race, (d) fallout.

d 9. When one nation announces that it will reduce its weapons regardless of what another does, this policy is called (a) a test ban, (b) a freeze, (c) bilateral disarmament, (d) unilateral disarmament.

b 10. Hibakusha is the name for (a) a city in the Soviet Union, (b) Japanese survivors, (c) the atomic bomb dropped on Japan, (d) the hundredth monkey.

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b 11. *The Hundredth Monkey* is really a story about (a) sweet potatoes, (b) the ability of the individual to make a difference, (c) creation, (d) 10 different ways to compromise.

c 12. Putting dangerous bacteria in the air or water supply is an example of (a) chemical warfare, (b) a type of new warhead, (c) biological warfare, (d) peaceful negotiation.

The following are either true (T) or false (F):

false 13. Half the people in the world live in the United States or the Soviet Union.

true 14. Conflict resolution is settling disputes.

false 15. The United States is larger in size than the Soviet Union.

false 16. An opinion is always the truth.

true 17. Fission is the splitting of atoms.

false 18. Fallout is a measure of energy in a nuclear weapon.

true 19. A bomb is a weapon.

true 20. Conflict is not always bad.

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Worksheet 10-2

EISENHOWER

Dwight D. Eisenhower was Supreme Allied Commander in Europe during World War II and one of the principal architects of the military victory over Nazi Germany. For two terms, from 1953 to 1961, he served as president of the United States.

Have students read the following Eisenhower quotes and respond to the questions which follow them:

> . . . One who has witnessed the horror and the lingering sadness of war—is one who knows that another war could utterly destroy this civilization which has been so slowly and painfully built over thousands of years . . . .
>
> Every gun that is made, every warship launched, every rocket fired, signifies in a final sense a theft from those who hunger and are not fed—those who are cold and not clothed.
>
> This world in arms is not spending money alone—it is spending the sweat of its laborers, the genius of its scientists, the houses of its children.
>
> I like to believe that people in the long run are going to do more to promote peace than are governments. Indeed, I think that people want peace so much that one of these days governments had better get out of their way and let them have it.

1. What do you suppose Eisenhower meant by the "lingering sadness of war"?
2. Why do you suppose Eisenhower thought that "another war could utterly destroy civilization"?
3. Why does Eisenhower call the making and use of guns, warships and rockets "a theft from those who hunger and are not fed—those who are cold and not clothed"?
4. What did Eisenhower see as the cost—besides money—of armaments? Explain.
5. Do you share Eisenhower's belief that people will do more than governments to promote peace? Why?
6. How can people make governments "get out of the way" so that peace can be achieved? Is the answer the same for the United States and the USSR?

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Appendices

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APPENDIX 1

RESOURCES

AUDIOVISUALS

Atomic Cafe. Color, 87 min. Archives Project, P.O. Box 438 Canal St. Sta. New York, NY 10013. Feature film on the development of the atomic bomb and the futility of civil defense.

Bombs Will Make the Rainbow Break. 16 mm or ½ or ¾ video, color, 17 min. Zahm-Hurwitz Productions, 43 W. 93rd St., New York, NY 10025. Depicts through children's voices and artwork the impact of growing up in a world on the brink of destruction. Excellent introduction for Lesson 1 of this unit.

Countdown for America. 16 mm, color, 25 min. $35 rental. American Security Council, 499 S. Capitol St., Washington, DC 20003. A critical assessment of the proposed bilateral freeze on deployment of nuclear weapons.

Disarmament: A Select Film Bibliography. The Riverside Church Disarmament Program, 490 Riverside Dr., New York, NY 10027.

Dr. Strangelove. 16 mm, 90 min. Swank Motion Pictures, 393 Front St., Hempstead, NY 11550.

Eight Minutes to Midnight. 16 mm, color, 60 min. Direct Cinema Ltd., P.O. Box 315, Franklin Lakes, NJ 07417. Nominated for an Academy Award, documentary portrait of Dr. Helen Caldicott, antinuclear activist, doctor, wife, and mother.

John, Mary, MIRV and MARV: The Arms Race and the Human Race. Slide show with cassette, 24 min., 1979. $7 rental. Institute for World Order, 777 UN Plaza, New York, NY 10017. Examines issues and questions concerning national security, such as—How real is the Soviet threat to our national defense? What does being "number one" mean in the nuclear age? How can we better achieve national security?

The Last Epidemic. ¾ video, ½ Betamax, color, 48 min. AFSC, 2161 Massachusetts Ave., Cambridge, MA 02140. $15.00. Doctors speak out on the dangers of nuclear war to health and survival.

The Last Slide Show. Carousel with cassette. 23 min. Packard Manse Media Project, Box 450, Stoughton, MA 02072. Disarmament seen as an issue of life over death.

Media Network. Information Center, 208 West 13th Street, New York, NY 10011. (212) 620-0878.

NO FIRST USE: Preventing Nuclear War. 16 mm, color, 30 min. Union of Concerned Scientists, 26 Church St., Cambridge, MA 02238. Examines issues concerning U.S. willingness to use nuclear weapons first in Europe.

No Frames. No Boundaries. 16 mm, ¾ video, color, 21 min. Creative Initiatives, 222 High St., Palo Alto, CA 94301. Explores "frames" of reference and artificial "boundaries" that exist between nations and the current spending of $500 billion each year for armaments to defend them.

The SALT Syndrome. 16 mm, color, 26 min. $25 rental. American Security Council, 499 S. Capitol St., Washington, DC 20003. A critical view of the effects of SALT II on American security.

Threat of Nuclear War. Slide show. Union of Concerned Scientists, 26 Church St., Cambridge, MA 02238. Sixty slides which depict the history of the nuclear arms buildup. A thorough look at U.S. and Soviet weaponry, as well as the effects of a nuclear explosion.

Tilt. Color, 20 min., 1972. $10. Material Distribution Services, 341 Ponce de Leon, NE, Atlanta, GA 30308. Animated analysis of the problems of population, ecology, pollution, national development, international relations, and world armaments.

War Without Winners II. Color, 28 min., 1982. Free except for postage. Michigan International Council, Rm. 8, Kellogg Center, MSU, East Lansing, MI 48824. American and Soviet people expressing their fears, thoughts, and hopes about the future in an age of nuclear weapons.

BOOKS AND ARTICLES

Abrams, Grace C., and Schmidt, Fran. *Learning Peace.* Philadelphia: Jane Addams Peace Association, 1974.

Arms Control Association. *Arms Control and National Security: An Introduction.* Washington, D.C.: The Association, 1982.

Blume, Judy. *Tiger Eyes.* New York: Dell Publishing Co., 1981. A young adult novel that deals affectingly with grief and adjustments to death. The novel is set near Los Alamos, New Mexico.

Caldicott, Helen. *Nuclear Madness: What Can We Do?* Brookline, Mass.: Autumn Press, 1979.

Carpenter, Susan. *A Repertoire for Peacemaking Skills.* New York: Peace Education Project of COPRED, 1977.

Crossroads. Boston: Jobs with Peace, 1981. A high school curriculum on nuclear war for science, English, and social studies.

The Effects of Nuclear War. Washington, D.C.: Office of Technology Assessment, 1980.

Fallows, James. *National Defense.* New York: Random House, 1981.

Farley, Philip J., and others. *Nuclear Arms Control: Options for the 1980s.* Washington, D.C.: Arms Control Association, 1982.

Ford, Daniel; Kendall, Henry; and Nadis, Steve. *Beyond the Freeze: The Road to Nuclear Sanity.* Boston: Beacon Press, 1982.

Galbraith, John Kenneth. "The Economics of the Arms Race—and After." *Bulletin of the Atomic Scientists,* June/July 1981.

Gallagher, Mary Beth, and others. *Educating for Peace and Justice: A Manual for Teachers.* Rev. ed. St. Louis: Institute for Peace and Justice, 1981.

Ground Zero. *Nuclear War: What's in It for You?* New York: Pocket Books, 1982.

Has America Become Number 2? Washington, D.C.: Committee on the Present Danger, 1982.

Hersey, John. *Hiroshima.* New York: Bantam Books, 1964.

How Realistic Is the Nuclear Freeze? Washington, D.C.: American Security Council, 1982.

Is the Reagan Defense Program Adequate? Washington, D.C.: Committee on the Present Danger, 1982.

Kennedy, Edward M., and Hatfield, Mark O. *Freeze! How You Can Help Prevent Nuclear War.* New York: Bantam Books, 1982.

Keyes, Ken, Jr. *The Hundredth Monkey.* St. Mary, Ky.: Vision Books, no date.

Lewis, Kevin N. "The Prompt and Delayed Effects of Nuclear War." *Scientific American,* July 1979.

Nesbitt, William A., ed. "Teaching Global Issues Through Simulations: It Can Be Easy." *Intercom* 75, Summer 1974.

______________; Abramowitz, Norman; and Bloomstein, Charles. "Teaching Youth About Conflict and War." In *Teaching Social Studies in an Age of Crisis.* NCSS Bulletin No. 5. Washington, D.C.: National Council for the Social Studies, 1973.

______________, and Karles, Andrea B. "Teaching Interdependence: Exploring Global Challenges Through Data." *Intercom* 78, June 1975.

Nuclear Disarmament Curriculum. Cambridge, Mass.: Educators for Social Responsibility, 1981.

Organizing for Nuclear Disarmament. Watertown, Mass.: Women's Action for Nuclear Disarmament, 1981.

Schell, Jonathan, *Fate of the Earth.* New York: Alfred A. Knopf, 1982.

Sivard, Ruth Leger, ed. *World Military and Social Expenditures.* Leesburg, Va.: World Priorities, 1981.

Smith, Gary R. *Cultural Sight and Insight: Dealing with Diverse Viewpoints and Values.* New York: Global Perspectives in Education, 1979.

Speaker Training Syllabus. Cambridge, Mass.: Greater Boston Physicians for Social Responsibility, 1982.

Unforgettable Fire. New York: Pantheon Books, 1977. Drawings and commentary by atomic bomb survivors, compiled by the Japan Broadcasting Corporation.

ORGANIZATIONS

American Enterprise Institute for Public Policy Research
1150 17th St., NW
Washington, DC 20036

American Friends Service Committee
1501 Cherry St.
Philadelphia , PA 19102
Offers materials on the arms race.

American Security Council—Coalition for Peace Through Strength
499 S. Capitol St.
Washington, DC 20003
Supports a military buildup to increase national security. Includes an active congressional affiliate.

Center for Defense Information
600 Maryland Ave., SW, Suite 303 West
Washington, DC 20024
(202) 484-9490
Publishes information and conducts research on defense, arms control, and disarmament issues.

Children's Creative Response to Conflict (CCRC)
Box 271
Nyack, NY 10960
(914) 358-4601
Exercises to increase cooperation, communication, affirmation, and conflict resolution are at the core of this program.

Coalition for a New Foreign Policy
120 Maryland Ave., NE
Washington, DC 20002
Mobilizes grassroots attention toward congressional attempts to conduct a noninterventionist, humane, and open U.S. foreign policy.

Committee on the Present Danger
1800 Massachusetts Ave., NW
Washington, DC 20036
Supports a strong national defense. Publishes occasional papers on national security issues.

Consortium on Peace Research Education and Development (COPRED)
1140 Avenue of the Americas
New York, NY 10036
Curriculum materials.

Council on Economic Priorities
Conversion Information Center
84 Fifth Ave.
New York, NY 10011
(212) 691-8550

Council for a Livable World
100 Maryland Ave., NE
Washington, DC 20082
(202) 543-4100

Educators for Social Responsibility
639 Massachusetts Ave.
Cambridge, MA 02139
(617) 492-1764
Offers *Creating Our Future: A Day of Dialogue Planning and Resource Guide*, a bibliography, a primer on the arms race, and other materials.

Facing History and Ourselves National Foundation, Inc.
25 Kennard Rd.
Brookline, MA 02146
(617) 734-1111 X335
Curriculum entitled "Decision-Making in a Nuclear Age"

Federation of American Scientists
307 Massachusetts Ave., NE
Washington, DC 20002
Organization of scientists concerned with the use of science in society—especially nuclear weapons.

Global Education Associates
552 Park Ave.
East Orange, NJ 07017
(201) 675-1409
An educational organization that facilitates the efforts of concerned people of diverse cultures, talents, and experience in contributing to a more humane and just world order.

Ground Zero
806 15th St., NW
Suite 421
Washington, DC 20005
(202) 638-7402
Offers a curriculum guide and audiovisual materials on nuclear war.

Institute for Defense and Disarmament Studies
251 Harvard St.
Brookline, MA 02146
(617) 734-4216
Offers a disarmament newsletter and research studies.

Institute for Peace and Justic
4144 Lindell, #400
St. Louis, MO 63108

Institute for World Order
777 United Nations Plaza
New York, NY 10017
(212) 490-0010
Engaged in research and education concerned with the establishment of a system of world order.

Jane Addams Peace Association
1213 Race St.
Philadelphia, PA 19107
Offers resource manual for secondary teachers.

Jobs with Peace
10 West St.
Boston, MA 02111
(617) 451-3389
A nationwide effort to transfer money from unnecessary military programs to civilian programs in education, the arts, health care, housing, and mass transit. High school curriculum on nuclear war available.

Lawyers Alliance for Nuclear Arms Control
P.O. Box 9171
Boston, MA 02114
(617) 227-0118

Members of Congress for Peace through Law (MCPL)
Room 3538, House Annex II
U.S. House of Representatives
Washington, DC 20515
Bipartisan group of congresswomen and congressmen concerned about world peace. MCPL is working to increase congressional commitment to human rights, arms control, and more effective foreign aid.

Mobilization for Survival
3601 Locust Walk
Philadelphia, PA 19104
(215) 386-4875

Network to Educate for World Security
777 United Nations Plaza
New York, NY 10017
Proposes establishment of a U.N.-sponsored disarmament fund devoted to worldwide peace and security education.

Physicians for Social Responsibility
639 Massachusetts Ave.
Cambridge, MA 02139
(617) 497-7440
Dedicated to professional and public education on the medical hazards of nuclear weapons and nuclear war.

Riverside Church Disarmament Program
490 Riverside Dr.
New York, NY 10027
(212) 749-7000
Organizes conferences and provides speakers and resources on disarmament education.

SANE
514 C St., NE
Washington, DC 20002
(202) 546-4868
Mobilizes grassroots support for American initiatives for peace and disarmament, including efforts for economic conversion.

Science for the People
897 Main St.
Cambridge, MA 02139
(617) 547-0307

Student-Teacher Organization to Prevent Nuclear War (S.T.O.P. Nuclear War)
Box 232
Northfield, MA 01360
(413) 498-5311
NEA-sponsored group that offers materials for secondary teachers and publishes a newsletter.

Union of Concerned Scientists (UCS)
26 Church St.
Cambridge, MA 02238
(617) 547-5552
Conducts public education projects on the nuclear arms race and national defense policy. Organizes conferences, publishes books, films, and curricular materials.

Women's International League for Peace and Freedom (WILPF)
1213 Race St.
Philadelphia, PA 19107
(215) 563-7110
Founded in 1915, WILPF publishes current analyses on disarmament and social justice issues, often with special reference to the actions of Congress and international organizations.

World Council for Curriculum and Instruction
Box 171
Teachers College, Columbia University
New York, NY 10027
WCCI seeks to develop curricula for international cooperation, peace, and global community building.

World Without War Council
175 Fifth Ave.
New York, NY 10010
(212) 674-2085
A national organization whose overall purpose is to help end war through the peaceful change of U.S. foreign policy and the strengthening of international institutions.

PERIODICALS

The following is a select list of scholarly journals, magazines, and resource newsletters useful to teachers, students, and researchers. For more information about a particular periodical, please write directly to the journal or newsletter concerned.

Arms Control Today. Arms Control Association, 11 Dupont Circle, NW, Washington, DC 20036. Monthly.

Braking Point. Union of Concerned Scientists, 26 Church St., Cambridge, MA 02238. Quarterly.

The Bulletin of the Atomic Scientists. 1020–24 E. 58th St., Chicago, IL 60637. 10 issues per year.

Defense Monitor. Center for Defense Information, 600 Maryland Ave., SW, Suite 303 West, Washington, DC 20024. (202) 484-9490. 10 issues per year.

Disarmament Times. Room 7B, 777 United Nations Plaza, New York, NY 10017. 8 issues per year.

Foreign Affairs. Subscription Dept., P.O. Box 2615, Boulder, CO 80321. Quarterly.

Foreign Policy. 11 Dupont Circle, N.W., Washington, DC 20036. Quarterly.

Foreign Policy and Defense Review. American Enterprise Institute for Public Policy Research, 1150 17th St., NW, Washington, DC 20036. 6 issues per year.

Intercom. Global Perspectives in Education, Inc., 218 E. 18th St., New York, NY 10003. Quarterly.

International Security. The MIT Press Journals, 28 Carleton St., Cambridge, MA 02142. Quarterly.

Journal of Conflict Resolution. Center for Conflict Resolution, SAGE Publications Inc., 275 S. Beverly Dr., Beverly Hills, CA 90212. Quarterly.

Washington Report. American Security Council—Coalition for Peace Through Strength, 499 S. Capitol St., Washington, DC 20003. Monthly.

APPENDIX 2

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The Threat of Nuclear War

Nuclear War: No Place to Hide

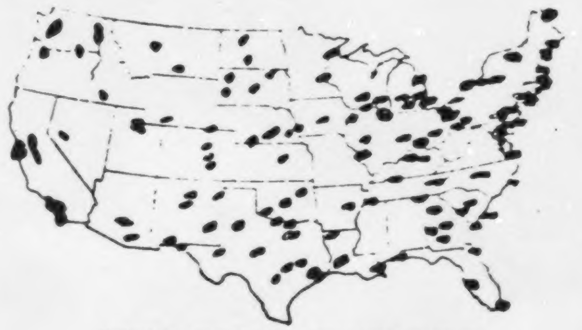
Today, with nuclear tests underground and out of sight, most people are not aware of the awesome power of nuclear weapons.

A single one megaton nuclear weapon which is detonated over a major city would mean the following:

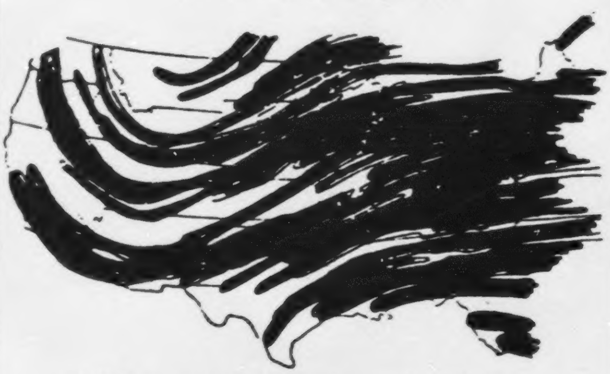
- a fireball—over a mile in diameter if detonated above ground; a crater—1,000 feet in diameter and 300 feet deep if detonated on the ground;
- 50 square miles of total destruction by blast and fire; 600 square miles in which all unprotected people would be killed;
- close to 500,000 fatalities; total casualties over 750,000; and
- 1,000 square miles—the size of Rhode Island—in which all persons looking at the fireball would be permanently blinded; 4,000 square miles—the size of Connecticut—blanketed with deadly radioactive contamination;

In a **full-scale nuclear war** between the United States and the Soviet Union:

- as many as 50,000 nuclear weapons could be detonated;
- in excess of 100 million Russians and a comparable number of Americans would be killed outright, and at least another 50 million in each country would die of injuries;
- deadly fallout would blanket large portions of the United States and the Soviet Union; air, water, and land would be contaminated; livestock and crops would suffer enormous destruction;
- in both nations medical facilities and personnel would be largely destroyed; little help of any kind would come to the survivors, many of whom would die from starvation and epidemics;
- the superpowers would have their industry, agriculture, and communications destroyed. They would be shattered societies, unable to recover for an indefinite period. Widespread death and destruction would hit many bystander nations; and
- smoke and dust from blast and fire, and destruction of ozone in the atmosphere, might severely damage the global environment and the biosphere.



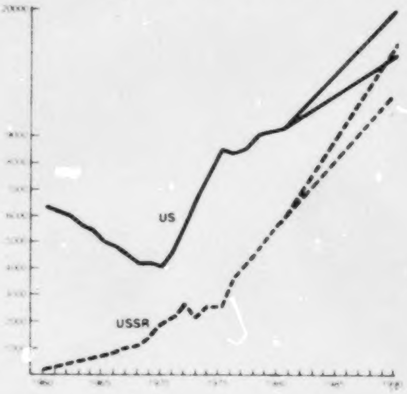
Fallout areas at 1 hour after a nuclear attack on U.S. Military Installations



Fallout areas at 24 hours after a nuclear attack on U.S. Military Installations

The Arms Race: Overkill and Overreaction

Total US & USSR Strategic Nuclear Weapons



The relentless nuclear arms race is well illustrated by the steep curves above. The curves show the total number of nuclear warheads and bombs that each of the two superpowers can deliver via long-range missiles and bombers. The US has over 9000 today, the Soviets some 7000. Note that the US has always been ahead of the Soviets, even during the alleged "missile gap" of 1960. The mid-1960's dip in numbers of US weapons is due to a drawdown of obsolete long-range bombers. The sharp rises for the US and USSR in 1970 and 1975 respectively illustrate the development of MIRVing capabilities—placing multiple warheads on missiles. The 1980's arms race may witness both superpowers increasing their nuclear arsenals by 7000 or more warheads and bombs.

Where will we be in a decade if the nuclear arms race continues unabated? Present expectations are:

- **seventy-five thousand nuclear warheads**—in the U.S. and Soviet arsenals with an explosive power approaching two million Hiroshima bombs.
- **more than ten thousand missiles and bombers**, in the United States and Soviet nuclear forces—double the number today;
- **over $300 billion** spent on nuclear missiles, aircraft, and bombs by the United States alone—$6,000 from each American family.
- **small, concealable weapons systems** that could deliver thermonuclear warheads unverifiable by agreements or ordinary detection systems. Today, bombs with Hiroshima level destructive power can fit in a 6 inch shell or rocket. They use only a grapefruit-size amount of plutonium.
- **ten or more nations**—some highly volatile—may have nuclear weapons. Terrorist groups may have acquired Hiroshima-size bombs.

Miscalculations by the U.S. about Soviet arms build-ups have led in the past to U.S. overreaction:

- The "bomber gap" of 1955 projected that the Soviets would have 600-700 long-range bombers by 1959. In reality, they actually built 190 by 1961 and have about 150 today. We had built over 600 by 1961.
- The "missile gap" of 1960 projected that the Soviets would have 1,000 missiles by 1961. They actually had ten by that time, while we built 1,000 by 1967.
- The "ABM gap" of the 1960's projected that the Soviets would have 10,000 ABM's by 1970. They had constructed 64 when the ABM treaty was signed in 1972.
- In anticipation of this Soviet ABM system we deployed multiple warhead missiles (MIRV). The Soviets then followed with their own MIRV program.
- Projections made in 1977 by influential defense analysts now serving in this administration estimated the Soviets would have almost 11,000 nuclear warheads by 1982. This is more than 50% above official estimates of the current Soviet inventory, but close to the present size of the U.S. strategic nuclear arsenal.

A miscalculation now current suggests that the United States is vulnerable to a Soviet "bolt from the blue" nuclear attack. But even if the U.S. land-based missiles were totally destroyed in such a surprise attack—itself virtually impossible—our submarine and bomber fleet would remain largely intact and would devastate the Soviet Union with the equivalent of hundreds of thousands of Hiroshima bombs.

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Proliferation: Out-Racing Our Will and Capacity to Control

In 1945 only the United States had nuclear bombs. General Groves, wartime Manhattan Project leader, predicted a U.S. monopoly until 1965. By 1949 the Soviets had exploded their first nuclear weapon followed by Great Britain in 1952. By 1965, France and China had enlarged the nuclear club to five.

Continued proliferation of nuclear weapons is a deadly threat to all nations. Nuclear exchange between minor powers, allied to the superpowers, or possessing vital resources such as oil, could draw in the superpowers, and lead to general nuclear war.

Further nuclear proliferation appears very likely:

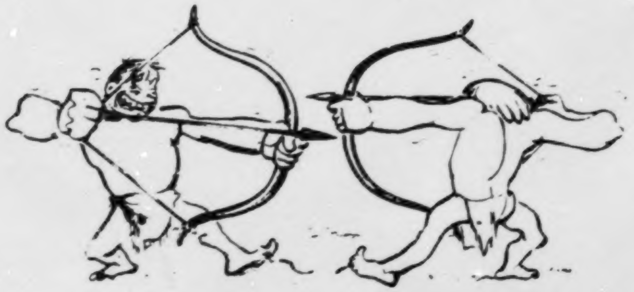
- India exploded a "peaceful" nuclear device in 1974.
- Flares recently detected by satellite sensors off South Africa looked suspiciously like nuclear tests.
- Israel destroyed an Iraqi nuclear research reactor in 1981 for fear that Iraq was building a bomb.
- Thirty-five nations have not signed the 1968 Non-Proliferation Treaty, and another eight have not ratified it.
- Thirty-seven non-nuclear states, signatories to the Non-Proliferation Treaty, do not have safeguards to help prevent diversion of nuclear materials from power reactors.
- Libya has actively sought nuclear weapons.
- Pakistan is believed to have a nuclear weapons program.
- There is reason to believe that Israel, and perhaps also South Africa, have completed virtually all the steps necessary to construct nuclear weapons.

Nations with nuclear weapons in 1981

China
France
Great Britain
India (?)
Soviet Union
United States

Nations which could have nuclear weapons by 1991

Argentina
Brazil
Iraq
Israel
Libya
Pakistan
South Africa
South Korea
Taiwan



THE TIGHTER I DRAW THE BOW, THE SAFER I BECOME

1991: Neutron Bombs and More

Unchecked weapons technology could lead to:

Ever more accurate multiple warhead ballistic missiles. The combination of accuracy and multiple warheads, in the hands of both superpowers, is leading the U.S. and Soviet leaders to believe that their fixed, land-based missiles are threatened. This could raise the risk of a preemptive first strike.

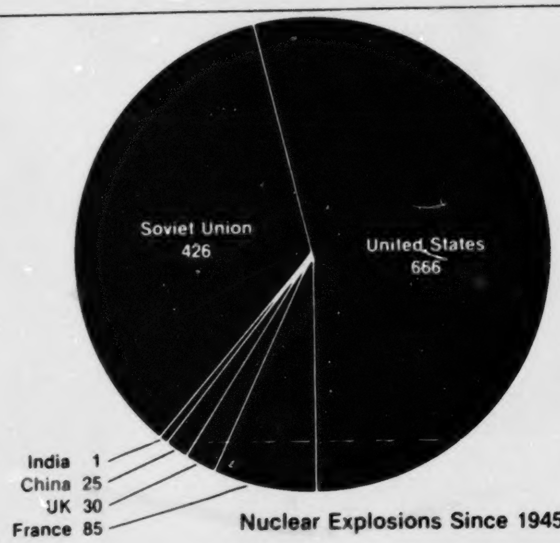
Thousands of nuclear-tipped cruise missiles, small enough to be launched from large trucks or readily placed on ships and planes around the world. Because these missiles can be easily concealed, no nation will be certain of the military threat it faces. Once deployed, these missiles will be impossible to limit, because they are impossible to monitor with confidence.

Anti-ballistic missiles that will breed their own arms race of thousands of offensive weapons to overwhelm them.

Anti-satellite weapons that will threaten our vital nuclear command, communications, and warning systems, whose destruction could trigger a nuclear war out of ignorance alone.

Neutron bombs that will make nuclear war in Europe appear limited and more "acceptable", hence more likely.

Weapons in outer space that will surround the planet with "Star Wars" technology and orbiting nuclear forces.



Nuclear Explosions Since 1945

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THE 1982 ARMS CONTROL DEBATE

Nuclear Parity: The Arms Race Standoff

In March 1981, President Reagan alleged that "the Soviet Union does have a definite margin of superiority" over the U.S. in nuclear striking power. Many experts disagree, however, and the President's statement remains a point of debate today.

The problem is that the strategic arsenals of the United States and the Soviet Union are not mirror images of one another. Comparing them to see who's ahead or who's behind cannot simply be based on any one measure of nuclear strength.

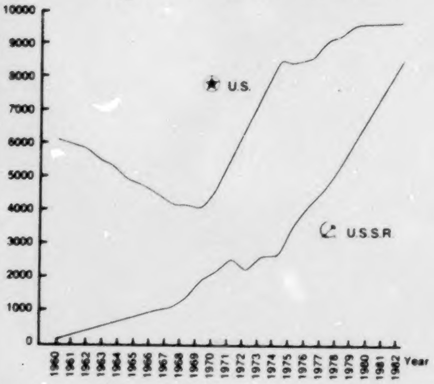
The strategic nuclear forces of both nations consist of a triad of land-based intercontinental ballistic missiles (ICBMs), submarine-based missiles (SLBMs) and long-range bombers. (Both NATO and the Warsaw Pact also deploy thousands of tactical or battlefield nuclear weapons in Europe.) Here any similarity between the arsenals ends.

The greatest difference is in the basing schemes used by the two superpowers. Of the 7,700 warheads in the Soviet triad, approximately 70 percent are on land-based missiles. The remaining Soviet warheads are divided between submarines (about 25 percent) and bombers (about 4 percent). Of the U.S. total of about 9,500 strategic warheads, only 23 percent are carried by ICBMs. Almost 50 percent of the U.S. strategic nuclear force, is carried by submarines. Moreover, the U.S. keeps more than half of its missile submarines on patrol at any given time. Only about 15 percent of Soviet submarines are on patrol at sea at any one time.

Comparison is further complicated by the fact that Soviet land-based missiles are generally larger than their American counterparts and have greater lifting power and larger warheads. U.S. missiles are considered more accurate than Soviet missiles, although the accuracy of Soviet missiles is improving.

When broken down into their component parts, some measures show a U.S. lead, and other measures a Soviet lead. Both nations, however, clearly have a sufficiently large number of diverse and survivable weapons systems so that neither can confidently attack the other without risking devastating retaliation. The end result: nuclear parity and mutual deterrence.

Total Strategic Nuclear Weapons United States—Soviet Union



The curves above show the total number of nuclear warheads and bombs that the two superpowers can deliver via long-range missiles and bombers.

Sources: 1982 Pentagon Annual Report; Center for Defense Information.

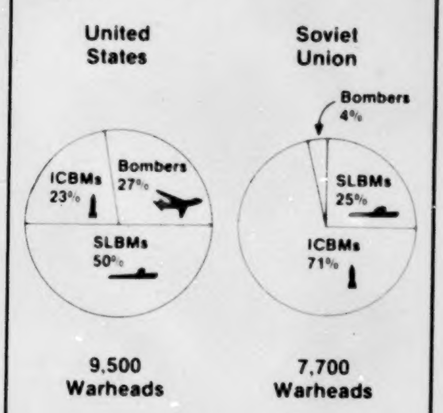
Strategic Expansion Continues

Despite this condition of apparent nuclear parity, the Reagan Administration is advocating a huge expansion in the nuclear forces of the United States. The Administration's build-up is expected to cost about $200 billion over six years. The six major components of the program are:

- Deployment of 100 MX missiles with at least ten highly accurate warheads per missile.
- Continued production of Trident submarines (two are currently in operation) and development of the more accurate Trident D-5 missile.
- Production of 100 B-1 bombers to replace the fleet of B-52s, and deployment of thousands of air-launched cruise missiles.
- Improved command, control, and communications systems.
- Continued research and development of anti-ballistic missile systems, and development of anti-satellite weapons; and
- Improved civil defense and air defense.

The Soviets are also expanding and improving their strategic forces. The deployment of Soviet SS-18 and SS-19 ICBMs, with their improved accuracy and large payloads, has added a new round of instability to the arms race, as has the introduction of the mobile SS-20s which threaten Western Europe. The Soviets are also testing new SLBMs and large missile-carrying submarines, such as the Typhoon. They may also be developing a new long-range bomber.

SUPERPOWERS' STRATEGIC ARSENALS



Are We Closer to the Brink?

Fear of nuclear war has increased substantially in the past year. This renewed anxiety is not unfounded and can be traced to several sources:

- widely publicized policy directives in which the U.S. Secretary of Defense has instructed the military services to prepare for fighting "limited" and "protracted" nuclear wars;
- continued emphasis on building the highly accurate MX missile to close a fictitious "window of vulnerability," even though the wisdom of proposed basing schemes has been seriously challenged. Many believe that deployment of first-strike weapons like the MX will lead to a situation in which each superpower will feel vulnerable to an attack by the other, and might launch a pre-emptive strike in a crisis situation as a means of self-defense.
- increased risk of nuclear accidents as the number of nuclear weapons increases and as the short delivery time of new weapons forces both countries to consider computerized "launch-on-warning" decision systems;
- renewed discussion of anti-ballistic missile systems (ABMs) resulting in fear that the Administration is preparing to scrap one of the most successful arms control agreements yet concluded – the ABM Treaty of 1972; and

- continued explicit reliance on nuclear weapons for the defense of Europe and other "hot spots" such as the Middle East. In a serious conflict with the Soviet Union, the U.S. would almost certainly be forced to initiate the use of nuclear weapons in response to a setback in a conventional conflict.

Arms Control Options: What Do They Mean?

The public response to these policies, combined with extensive grassroots organizing on nuclear issues, has stimulated widespread debate on various options for achieving arms control and reducing the threat of nuclear war. Numerous arms control proposals are now under discussion, including a nuclear FREEZE, SALT II, START, a Comprehensive Test Ban, and No-First-Use.

The Nuclear Freeze

First discussed in 1964, the most recent freeze proposals have become the basis for a national movement. In calling for a halt to the nuclear arms race, freeze advocates seek: a "mutual freeze on the testing, production and deployment of nuclear weapons and of missiles and new aircraft designed primarily to deliver nuclear weapons." At present, the Senate is considering a proposal (the Kennedy-Hatfield Resolution) which advocates a moratorium on the testing, production, and deployment of nuclear weapons and calls for subsequent negotiations to reduce the number of weapons possessed by the two superpowers. A companion resolution in the House of Representatives was narrowly defeated (204 – 202) in August 1982. Instead, the House passed a resolution calling for negotiated reductions followed by a freeze. This position was preferred by President Reagan, at least in part because it permits continued production of nuclear weapons.

SALT II

After years of negotiation, SALT II was signed in 1979. Ratification of it by the U.S. Senate was indefinitely suspended not long after, largely because of reaction to the Soviet invasion of Afghanistan. More recently however, the Reagan Administration has said the U.S. would do nothing to undermine the Treaty so long as the Soviets concurred. A complex agreement, SALT II would:

- permit each side a total of 2,400 strategic systems (launchers for ICBMs, SLBMs and long-range bombers) at the outset, to be reduced to 2,250 during the duration of the treaty;
- set a sub-limit of 1,320 on launchers for multiple warhead (MIRV'd) ICBMs, SLBMs, and bombers with long-range cruise missiles; a sub-limit of 1,200 on MIRV'd ICBMs and SLBMs; and a sub-limit of 820 on MIRV'd ICBMs;
- restrict the testing and deployment of new types of ICBMs to one on each side;
- limit the number of MIRVs permitted on new and existing ICBMs;
- ban the Soviet SS-16–an intercontinental ballistic missile which may be converted into a mobile, intermediate-range ballistic missile (the SS-20);
- set ceilings on the launch-weight and throw-weight of strategic ballistic missiles;
- prohibit rapid reload ICBM systems.

START
Strategic Arms Reduction Talks

On May 9, 1982, President Reagan announced a two-phased U.S. proposal for the START talks, the successor to SALT I, and a replacement for SALT II. The U.S. proposed reducing *warheads* to equal ceilings of about 5,000 for each side (down from 9,500 for the U.S. and about 7,700 for the Soviets). To enhance stability by reducing any incentive or capacity each side might have to attack first, no more than half the remaining warheads would be land-based. The total number of ballistic *missiles* (ICBMs) would be reduced to 850, about half of the current U.S. level. The U.S. also proposed a second-phase reduction in ballistic missile throw-weight (the useful weight carried by a missile, i.e., guidance components and re-entry vehicles containing warheads) to below the current U.S. level. The replacement of existing systems with newer ones would be permitted under the proposal, including production of systems such as the MX and Trident.

At the same same time, however, President Reagan has said everything is "on the table," and all offers would be considered. In fact, the Soviets have countered by proposing a ceiling of 1,800 on ballistic missiles and heavy bombers on each side. The Reagan Administration regards this Soviet proposal as unacceptable, since in the Administration's view it does not focus sufficiently on land-based missiles, which are seen as the most serious threat to the U.S. (and which make up the greater part of the Soviet triad).

CTB–Comprehensive Test Ban

A Comprehensive Test Ban, which some have proposed as one component of a freeze, would prohibit underground nuclear tests, except possibly for tests of a few kilotons, which may be too small to detect using existing seismic techniques. Tests in the atmosphere, outer space, and underwater are already prohibited by existing agreements (the Partial Test Ban Treaty), as are underground tests having a yield above 150 kilotons (Threshold Test Ban Treaty).

In 1977, the United States, the Soviet Union, and the United Kingdom began negotiations on a comprehensive test ban. By 1980, when negotiations were suspended, they had made progress toward completion of a treaty. The parties had resolved some difficult verification issues, and had agreed in principle to permit on-site inspection of suspicious events. However, the Reagan Administration indefinitely postponed resumption of these talks, in part because the Administration wants to develop a variety of new nuclear warheads and delivery systems that might be seriously constrained by a CTB. Some U.S. officials also hold the widely disputed view that the U.S. would be unable to check the reliability of existing warheads, and as a result, confidence in our deterrent would decline.

No-First Use

This proposal would make it a matter of U.S. policy not to be the first to use nuclear weapons. No-First-Use is advocated as an alternative to current policy which calls for the NATO Alliance to initiate the use of nuclear weapons, if necessary, to turn back a conventional Soviet attack against Western Europe. Presently, nuclear weapons are viewed as a way of balancing numerically superior Warsaw Pact ground forces.

Because no plausible argument has been put forward that would guarantee that the use of nuclear weapons would remain "limited," a No-First-Use declaration would create a clear line of demarcation between conventional and nuclear war. Advocates of a No-First-Use policy believe that selected use of nuclear weapons to counter a setback in conventional conflict might not be stopped short of total escalation to all out nuclear war between the superpowers. No-First-Use, if adopted and accompanied by certain improvements in NATO's conventional defenses, would reduce the reliance of the U.S. and NATO on nuclear weapons, diminish the risk that nuclear war will occur, and strengthen the credibility of the Western deterrent to Soviet aggression.

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HAS AMERICA BECOME NUMBER 2?
The U.S.-Soviet Military Balance
and American Defense Policies and Programs[28]

THE MILITARY BALANCE

A. Strategic Nuclear Forces

A steady deterioration in the strategic nuclear balance has taken place. In all indices, save possibly (but doubtfully) numbers of deployed on-line warheads, Soviet superiority, given existing programs, will grow during the next few years. A study conducted in 1978 for an agency of the Department of Defense identified over forty indices of comparison between U.S. and Soviet strategic nuclear forces, and traced these from 1962 to 1982. In 1962, all favored the United States. In 1978, all but a few favored the Soviet Union. It was projected that by 1982 all would favor the Soviets; and this has occurred.[1]

The Chief of Naval Operations, Admiral Thomas Hayward, summarized it starkly during the 1979 SALT II hearings:

> "With respect to essential equivalence it is my view that without any question the Soviets will have a first-strike capability over the next few years. If that is not a loss of essential equivalence, I do not know what is, and we have to do something about that to correct it."[2]

Relentless efforts over the past twenty years have moved the Soviet Union from strategic inferiority to strategic superiority over the United States in nuclear capabilities. The Secretary of Defense states: "While our strategic programs have been restrained because of expectations for SALT and detente, the Soviets continually improve the quality of their strategic forces."[3] By 1968 the Soviets were spending twice as much as the United States, and the gap has subsequently widened to a 3.3 to 1 ratio.[4] The cumulative effects of this long-term trend have produced Soviet superiority in strategic nuclear forces.

Superiority, not parity, has been and continues to be the Soviet goal. For twelve years, the Soviets have asserted publicly that nuclear "balance" and "parity" exist between the two sides, while, at the same time, they have produced and deployed weapons systems on a scale and at rates far beyond standards in the West.

Soviet investment in military technology has now permitted the Soviets to shift emphasis from their earlier preoccupation with quantity to advancement of the quality of their strategic nuclear forces. This has produced a greater capability to destroy American strategic deterrent forces before they can be launched, as well as to provide for the survivability and endurance of their own forces. Having made great strides in these areas, it is possible that the Soviets will now place even greater emphasis on the ability to destroy, or negate the effects of, American deterrent forces after being launched. An overwhelming strategic nuclear reserve and secure command and control systems support both capabilities.

1. Soviet Programs

Since the Committee's previous assessment of the military balance, Soviet strategic nuclear capabilities have continued to grow. The Soviets produce approximately 200 ICBMs and 200 SLBMs every year, in a variety of modifications and with accurate MIRV warheads.[5] Last year, the Pentagon announced that "certain versions of the SS-18 and

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[1] *Measures and Trends: U.S. and USSR Strategic Force Effectiveness.* Report for the Defense Nuclear Agency, Santa Fe Corporation, Alexandria, Virginia, 1978.

[2] *Military Implications of the Treaty on the Limitation of Strategic Arms and Protocol Thereto,* Hearings, Senate Armed Services Committee, Part I, p. 177. (GPO, 1979) Admiral Hayward was strongly supported by General Richard Ellis, Commander of the Strategic Air Command in 1980, who stated: "An adverse strategic imbalance has developed and will continue for several years to come." See testimony of General Ellis before the Senate Armed Services Committee, 22 February 1980.

[3] Secretary of Defense, *Department of Defense Annual Report, FY 1983,* p. II-11.

[4] Secretary of Defense, *Department of Defense Annual Report, FY 1981,* pp. 73-74.

[5] U.S. Department of Defense, *Soviet Military Power,* Washington, D.C., US GPO 1981, p. 12.

[28] Committee on the Present Danger, Washington, D.C., 1982. Reprinted with permission of the Committee on the Present Danger.

SS-19 are among the most accurate ICBMs operational anywhere."[6] Subsequently, the Secretary of Defense stated, "Soviet missiles are now more accurate than ours.[7] More recently, senior Pentagon officials said that the latest version of Soviet ICBM warheads are more accurate than their U.S. counterparts.[8] This has enormous implications for U.S. ICBM survivability. Since the smallest Soviet MIRV warheads are twice as large as the largest U.S. MIRVs, their counterforce potential is far greater. Soviet Backfire bombers continue to be produced, and recent reports of a new Soviet B-1-type strategic bomber, which may well be in operational status before the B-1, have now been officially confirmed.[9]

The Soviet inventory of strategic ballistic missiles materially exceeds the numbers contained in SALT-accountable launchers. In 1980, the Soviets were reported to have staged an exercise that simulated the reload and refiring of up to 40 SS-18 silo-launchers.[10]

The Joint Chiefs of Staff have summarized the situation:

> "According to accumulating evidence, the Strategic Rocket Forces may have plans to reconstitute and reload at least a portion of their silo-based ICBMs during a protracted nuclear conflict. Contingency plans for the reloading and refiring of silos probably have been developed. The cold-launched SS-17 and SS-18 are well suited for refiring. Additional evidence supports the hypothesis that the hot-launch systems also have a reload and refire capability."[11]

In addition, evidence presented in Congressional hearings on SALT II suggested that Soviet ICBMs might be fired directly from their canisters without being reloaded in silo-launchers.

The number of Soviet strategic ballistic missiles with operational capability is unknown, but it probably greatly exceeds the number of missiles accounted by SALT counting rules; hence, the usually listed inventories of Soviet strategic missiles understate the actual situation.

This point was recently underscored by reports that the Soviets have SS-16 mobile ICBMs deployed at Plesetsk.[12] These missiles are not in the SALT accountable inventory because the Soviets said they had not been deployed, did not include them in the data provided in accordance with SALT II, and specifically promised that they would not be deployed.

Soviet strategic defensive programs complement their offensive programs and "point to a strategic concept of layered, in-depth defense of the homeland."[13] Extensive resources are committed to strategic defensive programs both active (ABM, air defense, anti-satellite, anti-submarine warfare) and passive (civil defense).

As to ABM capabilities, the Soviets have continued to modernize their deployed Moscow ABM system and have vigorously pursued research and development along a variety of lines. In air defense, the Soviets have maintained and modernized a rich bomber defense based upon 10,000 SAM launchers, more than 5,000 radars, and some 2,500 interceptor aircraft. "Soviet air defense systems are unsurpassed and are deployed in great variety and quantities."[14] The civil defense program costs more than the equivalent of $2 billion annually, an effort that has been sustained for a number of years.[15]

2. Evaluating U.S. Strategic Forces

Since the essence of American strategic policy is deterrence, and the foremost objective is deterrence of attacks on the United States and its allies, it is essential that our *surviving* forces—i.e., those that can confidently be expected to survive possible enemy attacks—be capable of accomplishing the missions set for them. It is not enough to look at the peacetime inventory of strategic nuclear weapons; one must also assess the adequacy of forces remaining after enemy attacks and countermeasures. Both static (peacetime) comparisons and dynamic (exchange, post-exchange) comparisons are important in assessing the strategic balance.

U.S. strategic forces are expected not only to deter attacks on the U.S. but also to play an important role in "extending deterrence" to allies (i.e., their use in situations where those forces have not themselves been attacked). In peacetime, U.S. strategic forces constitute an essential backdrop for foreign policy; in the event of local confrontations they must provide security against escalation so that other forces may be effective. And, for sound political

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[6] *Soviet Military Power*, p. 54.

[7] *Washington Post*, 16 April 1982, p. A 11. On the following day, the Pentagon's press officer issued a formal statement saying "some of the Soviet missiles are more accurate and some are not." *Washington Post*, 16 April 1982, p. A 11.

[8] *Air Force Magazine*, June 1981, p. 25.

[9] *Washington Post*, 4 March 1982, p. A1; also see *Defense Daily*, 1 March 1982, p. 3, and *Defense Daily*, 27 May 1982, p. 146.

[10] News Release from Congressman Robin Beard, 18 September 1980.

[11] *United States Military Posture for FY 1983*, p. 107.

[12] Rowland Evans and Robert Novak, "Soviet Freeze Warning," *Washington Post*, 5 April 1982; also, Henry Trewhitt, "Soviet Said to Display Long-Range Missiles," *Baltimore Sun*, 6 April 1982.

[13] *Soviet Military Power*, p. 64.

[14] *Soviet Military Power*, p. 65.

[15] *Soviet Military Power*, p. 68.

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and military reasons, it has been decided by successive administrations that our strategic forces must have, at a minimum, "essential equivalence" with those of the Soviet Union, in both reality and in the perception of others.

It is essential to evaluate the capabilities of surviving U.S. strategic forces in the event of enemy attack. This varies with differing attack scenarios. Planning for adequate forces following effective strategic warning (i.e., warning that is timely enough, unambiguous enough, and in response to which we do in fact take all necessary actions to increase force survivability) is far different from planning for adequate forces after a surprise attack. If effective strategic warning and effective U.S. responses to that warning (e.g., increasing the alert, dispersal, and operational rates of bomber and submarine forces; upgrading tactical warning, communications, and national command authority responsiveness) could be assumed with high confidence, there would be fewer demands placed on retaliatory forces than if the U.S. continued to plan deterrent forces that could absorb a surprise attack and still be wholly effective. The problem in many analyses of force adequacy is that the attack and response conditions assumed may be imprudently optimistic, elastic, or simply unarticulated. Published analyses by the Department of Defense in recent years have frequently reflected this sort of questionable method in an attempt to make forces and programs appear more satisfactory than they are. For example, even though both the FY 1980 and FY 1981 Department of Defense Reports stipulated that forces must be able to survive "a well-executed surprise attack" and still fulfill all planned missions, both reports reached conclusions as to the adequacy of U.S. forces by assuming (a) strategic warning, (b) Soviet attacks less than "well-executed" and (c) virtually unimpeded access to targets for our surviving forces.

The Committee believes that the standard of a "well-executed surprise attack" should be scrupulously followed in assessing the adequacy of forces. Further, a prudent deterrent must be designed to function in the absence of strategic warning. "Launch-on-warning," when applied to missile forces, is a high-risk, low-confidence option that can and should be avoided by providing for a survivable ICBM force.

Adequacy of forces should be evaluated in terms of the full range of missions that these forces are designed to accomplish. They must meet the objectives and criteria officially established for them. Unfortunately, judgments expressed on the adequacy of these forces often ignore these requirements. Frequently, assertions about the plentitude, or even over abundance, of forces are implicitly based not upon officially established standards but on lesser and more subjective ones, such as "assured destruction" or even "minimum deterrence." In these the full politico-military importance of strategic forces and the full range of objectives they must meet are disparaged or ignored. Former President Carter lent support to this approach when he suggested, in a State of the Union address, that the nuclear force represented by one Poseidon submarine was adequate to destroy 160 Soviet cities—an obvious hyperbole.

Usually implicit, sometimes explicit, is the assumption that U.S. strategic nuclear forces have only one purpose—to target cities. Without addressing all the fallacies of this view, surely a major fallacy is obvious today when *all* official estimates show that the U.S. would suffer far greater damage than would the Soviets by a city-attack exchange. Can such a threat then be made credible against a wide range of possible challenges? The answer is no. In reality, U.S. strategic forces have always had as part of their deterrent mission the option to attack targets other than cities, or, should deterrence fail, to attempt to limit damage. Surely U.S. force capabilities should provide a President with options other than a suicidal attack on cities, and having such options has been official policy for some time.

In the view of this Committee, assessments of strategic force adequacy based upon standards that fall well short of those officially established are inappropriate; hence, it is useful to review those standards contained in official doctrine.

Specific standards and requirements for judging the adequacy of our strategic forces have been officially established for some time. While they have been subject to modification, in essence they have been reaffirmed and reiterated by successive administrations since the Nixon Administration. They are definitely not reducible to minimum deterrence or assured destruction standards.

In 1969, the Nixon Administration added to the assured destruction criterion the need to avoid any major retaliatory force vulnerability in the interests of crisis stability, the need to be substantially equal to the Soviet Union in strategic capability, and the need to be able to limit damage at least against light nuclear attacks. In 1974, several specific requirements were added in the interests of maintaining deterrence, controlling escalation, and denying any Soviet political advantage from the buildup of their strategic forces. U.S. forces, it was declared, must be capable of "riding out even a massive surprise attack" and responding with a variety of controlled, selective, and limited strike options, including options against hardened counterforce targets, while still being able to "withhold an assured destruction reserve for an extended period of time." In addition, it was emphasized that U.S. forces must have visible and measurable capabilities at least equal to those of the Soviet Union, or "essential equivalence."

The annual reports of the Department of Defense under the Carter Administration were not quite as unequivocal. Indeed, they tended to display some uncertainty and ambiguity. Yet, in the final analysis, particularly after "PD-59" officially confirmed the basic tenets of the doctrine inherited from the Nixon and Ford Administrations, official Defense Department statements set forth similarly extensive and demanding standards. These appeared under the rubric of a "Countervailing Strategy" (of which the FY 1981 Report acknowledged, "the name is newer than the strategy"). U.S. forces must be able to "(1) survive a well-executed surprise attack; (2) penetrate any enemy defenses; (3) react with the timing needed, both as to promptness and endurance, to assure the deliberation and control deemed necessary; and (4) destroy their designated targets," in which are specifically included both soft and hard military targets. U.S. strategic forces must be able to control escalation and limit damage to the extent possible, rather than assure escalation and massive destruction by spasm or unlimited responses. A distinction between a "deterrence-only" and a defensive or denial capability was explicitly rejected. ("Our surest deterrent is our capability to deny gain from aggression. . . . There is no contradiction between this attention to the militarily effective targeting . . . and our primary and overriding policy of deterrence.")[16] Assured destruction is not "sufficient in itself as a strategic doctrine," and the U.S. must "have plans for attacks which pose a more credible threat than an all-out attack on Soviet industry and cities . . . while retaining an assured destruction capability in reserve."[17]

It is obvious, then, that official U.S. strategic deterrence doctrine, since at least 1974, has been based upon a need for enduring "war-fighting" capabilities, even for relatively protracted contingencies. The present Administration has only confirmed this. Sensational press reports of a major change in strategy to "war-fighting" and protracted nuclear conflict disguise the fact that such criteria have been officially accepted for some time. Reagan Administration policy, in this regard, reflects continuity, not major change.

Properly evaluated, then, the health and adequacy of our strategic forces must be assessed in that context. Unfortunately, neither today's capabilities nor those programmed for several years fulfill those criteria.

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[16] Secretary of Defense, *Annual Report, FY 1981*, p. 67.

[17] *Ibid.*, pp. 65-66.

APPENDIX 3

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NUCLEAR WEAPONS AND NUCLEAR WAR: A STUDY GUIDE

DRAFT: January 1983

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INTRODUCTION

For the last 35 years, the human race has lived with a day to day threat of nuclear annihilation. The resultant widespread anxiety has increased with current defense policies and statements about survivability and "limited" nuclear war. It is common knowledge that the United States and the Soviet Union have the capability to destroy eachother's population and industry. The potential long-term consequences for the planet are also relatively well known, including the dangers of radiation and the potential destruction of the ozone layer. However, many defense and arms control issues are not well understood. Frequently, important issues are surrounded by impenetrable jargon and obscured by opinions that are stated as facts.

This primer is an introduction to the arms race and nuclear issues. It is designed to provide basic information for an adult without an extensive technical background, who wants to understand the nature and potential consequences of nuclear war. The unit consists of eight sections, each of which deals with a subject area that may be considered in sequence or independently of the others.

The guide begins with background information on the nature and effects of nuclear weapons. It is followed by sections dealing with the history of the arms race, comparative measures of the military strength of the US and the USSR, and descriptions of the strategic policies that have served as the basis for nuclear deterrence. These four sections contain the basic material needed to understand the arms race and the positions of the US and the USSR. The next three sections provide more depth, including an explanation of the US strategic warning network, a description of new weapons systems and technological developments, and an assessment of the economic trade-offs inherent in military expenditures. The last section examines various arms control proposals, ranging from treaties now in effect to proposals that have not yet been negotiated.

For the reader who is interested in studying the entire unit, the suggested order is as follows:

I. Weapons effects and background information on nuclear weapons
II. Chronology of the arms race
III. Comparisons of military strength; who's ahead
IV. Strategic policy
V. Close calls and mistakes
VI. New weapons systems and developments
VII. Economic trade-offs
VIII. Solutions, treaties, and verification issues

Each section consists of an introduction to the issue, a set of questions for investigation or discussion, and suggested readings. Many of these issues are highly complex and technical; wherever possible, the readings emphasize less technical material. There is no suggested schedule for completion of the unit. The amount of time needed to gain a basic understanding of the issues will vary greatly, largely dependent upon the reader's level of interest and initial knowledge.

I. WEAPONS EFFECTS AND BACKGROUND INFORMATION ON NUCLEAR WEAPONS

In order to understand nuclear war, it is first necessary to comprehend the nature of nuclear weapons. There are several major differences between nuclear and conventional weapons. In conventional exposives, energy is released as a result of chemical reactions. In nuclear weapons, energy is released through the fission or fusion of atomic nuclei, capable of producing thousands of times more force than conventional explosives. Nuclear explosives require considerably less mass than conventional explosives to produce the same amount of energy. In addition, nuclear explosives produce far greater thermal effects, including sizeable "fire storms." Finally, nuclear explosions produce substantial immediate and long-term radiation dangers.

The first nuclear weapons (atomic bombs) were fission weapons, in which the fundamental reaction involved the splitting of an atomic nucleus. This reaction produced a great deal of energy; substantially more than with a traditional chemical reaction. For example, the complete fission of a pound of uranium or plutonium would release explosive energy equivalent to about 8000 tons of conventional explosives (TNT).

Further development of nuclear weapons led to a different principle in order to more efficiently produce even more massive amounts of energy. These weapons (hydrogen bombs) use fusion, or the merging of two nuclei, as the basis for the explosion. At very high temperatures, the two nuclei unite to form the nucleus of a heavier atom, a process that results in the release of substantial amounts of energy. For example, the fusion of all of the nuclei in a pound of the hydrogen isotope deuterium would release energy equivalent to about 26,000 tons of TNT.

For comparison, the A-bomb dropped on Hiroshima had an explosive force equivalent to 13 kilotons of TNT. Modern warheads such as those on a Minuteman III missile (which carries 3 warheads per missile) carry warheads with an explosive force of 350 kt, more than 25 times that of the Hiroshima bomb. The total explosive force of all of the conventional weapons used during World War II was approximately 2 megatons. Just two Minuteman III missiles equipped with the new Mark 12A warheads carry more than 2 megatons of explosive force.

QUESTIONS

What is a nuclear weapon? What is the difference between an A-bomb and an H-bomb? How do nuclear weapons work? How were they developed? What are the cases of actual use of such weapons? How do modern weapons compare with those dropped on Hiroshima and Nagasaki? What are the short and long-term effects of any use of nuclear weapons?

READINGS

Kevin Lewis, "The Prompt and Delayed Effects of Nuclear War," *Scientific American*, July 1979.

Michael Riordan, ed., *The Day After Midnight*, (Palo Alto, California: Cheshire Books) 1982.

Jonathan Schell, *The Fate of the Earth*, (New York: Alfred A. Knopf) 1982, Part I.

Samuel Glasstone and Philip J. Dolan, *The Effects of Nuclear War*, 3d ed. (Washington, D.C.: GPO) 1977, pp. 1-11.

II. CHRONOLOGY OF THE ARMS RACE

In order to understand the nuclear arms race, we must examine both past and current actions of the major nuclear powers. By analyzing the major weapons choices and the ways in which the nuclear arms race has escalated, we may be able to prevent further escalation. The arms race itself is a symptom of a larger problem of misperception, over-reaction, and mistrust. Only by comprehending this more general problem will we be able to reach constructive solutions.

The arms race has evolved out of a set of key weapons decisions, each of which has prompted a reactive response from the other side. Important developments included the following:

1945	US tested the first atomic bomb, "Trinity", at Alamagordo, New Mexico, July 16
	US dropped an atomic bomb on Hiroshima, August 6
	US dropped an atomic bomb on Nagasaki, August 9
1949	Soviet Union tested its first atomic bomb
1952	US tested its first hydrogen device
1953	Soviet Union tested its first hydrogen device
1957	Soviet Union conducted first full-range ICBM test
1958	US conducted first test of Atlas ICBM
1960	US launched first Polaris missile from submerged submarine
1964	Chinese detonated their first nuclear weapon
1968	US tested MIRV warhead
	Soviets launched their first nuclear powered missile submarine
1970	US began to deploy MIRV'ed ICBMs
1971	MIRV'ed Poseidon SLBMs operational
1973	Soviets conducted their first tests of MIRV'ed warheads
1975	Soviets began to deploy MIRV'ed ICBMs
1978	First Soviet MIRV'ed SLBM operational
1980	First Trident missile submarine enters US fleet
1982	US bombers equipped with long-range air launched cruise missiles (ALCMs)

QUESTIONS

What major choices have escalated the arms race? How many countries possess nuclear weapons? Did they all go through the same stages of development? What are the prospects for additional countries joining the "nuclear club"? With respect to major developments (including but not limited to ICBMs, SLBMs, MIRV, and ABM), which country has been the first to develop and/or deploy the system? Was there a bomber gap in 1955? A missile gap in 1960? How accurate were past assessments of Soviet weapons developments? What is the significance of the development of MIRV? What is the likely impact on the arms race of the deployment of advanced systems including the American MX, Trident II, and cruise missiles, or the Soviet SS-18 and SS-19 ICBMs?

III. COMPARISONS OF MILITARY STRENGTH; WHO'S AHEAD?

Analysts, academics, and politicians often compare US and Soviet force levels in order to determine which country has an advantage over the other. These comparisons assess the extent or seriousness of the national security threat posed by the other country. While it is important to understand the nature of US and Soviet military forces, it is essential to recognize the limitations of certain types of analysis. Analysis of US and Soviet forces frequently involves static or fixed comparisons, based on the number of missiles, warheads, or amount of explosive material each side possesses. However, such analysis fails to take into account the uses of these weapons. Comparing one ship to another is appropriate if they will serve the same function. However, if one is a carrier, and the other is a supply ship, the comparison is meaningless. Similarly, effectiveness is often not directly related to weight. Thus a smaller ship with more accurate or efficient weapons will be more useful in many circumstances than a larger ship with less accurate weapons. The difference is accentuated due to the potentially increased vulnerability of the larger ship.

In addition to large numbers of theater nuclear weapons, the US has over 9000 strategic warheads and bombs, of which approximately 25% are carried on ICBMs, 50% on SLBMs, and 25% on bombers. The Soviets have about 7000 strategic warheads, of which approximately 75% are carried on ICBMs, 20% on SLBMs, and 5% on bombers. Soviet missiles have greater throw weight (the capability to carry larger warheads with more explosive power), while US missiles are generally more accurate. The US has more bombers, which in turn have greater speed and range than Soviet bombers. US submarines are less noisy than Soviet submarines, and are consequently more difficult to detect. The US also has the advantage in anti-submarine warfare, but the Soviets have more air defenses with which to intercept a bomber attack.

QUESTIONS

What is the current status of the US and Soviet nuclear forces? How can the two forces be compared? Is there a "window of vulnerability?" Which country "leads" the nuclear arms race? Would more nuclear weapons change the relationship between the superpowers? What threats do the Soviets pose for the U.S. and our allies? What are U.S. perceptions of Soviet security goals? Soviet perceptions of U.S. security objectives? What threats does the U.S. pose for Soviet military planners? What are the purposes and capabilities of U.S. and Soviet defensive forces?

READINGS

George Kennan, "Reflections: Two Views of the Soviet Problem", The New Yorker, November 2, 1981.

American Friends Service Committee, "Questions and Answers on the Soviet Threat and National Security", 1981.

Colin Gray and Keith Payne, "Victory is Possible", Foreign Policy, #39, summer 1980.

Sources for information on annual expenditures and reports on force structure include World Military and Social Expenditures (Ruth Sivard), and The Military Balance (International Institute for Strategic Studies).

IV. STRATEGIC POLICY

The basis for strategic weapons decisions often lies in "doctrine", a term that refers to the structure of a nation's strategic plans. A key portion of the US nuclear doctrine concerns the ways in which the US attempts to deter nuclear war. US strategies to prevent nuclear war range from the formulation of plans to fight limited nuclear wars to plans for massive retaliation in the event of a Soviet attack of any magnitude.

In the past, one of the cornerstones of US strategic policy has been the conception of deterrence through the maintenance of a "triad" or mix of three different forces. The triad consists of bombers, land-based missiles, and submarine-launched ballistic missiles. For successful deterrence, each of the legs of the triad must be able to survive a Soviet nuclear attack, and in response do "unacceptable" damage to the Soviet Union. Unacceptable damage has been defined as the ability to destroy a substantial portion of Soviet industry and population. It has been calculated that a force equivalent to 400 one-megaton weapons could destroy 35% of the Soviet population and 70% of Soviet industry.

Some analysts have suggested that the triad is a costly and overly conservative strategy. They argue that the US would be just as safe, and our deterrent just as strong, if only two-thirds of the triad were capable of doing unacceptable damage in response to a Soviet attack. Others suggest that the US should adopt a policy of launching its ICBMs on warning of a Soviet attack, to avoid a "use them or lose them" situation. Opponents of this option stress the risks of accidental nuclear war, due to computer malfunction or miscalculation.

QUESTIONS

What are the meanings and potential consequences of the following deterrence strategies: containment; massive retaliation; flexible response and counterforce targetting; mutually assured destruction; limited nuclear war? Does the triad strengthen the US strategic position? What are the advantages and disadvantages of the Soviet concentration on land-based missiles? What are the primary arguments for and against a triad of strategic forces? To what extent do the stated policies of the U.S. and Soviet Union correspond to their capabilities? What is launch on warning? launch under attack? How could either be used to reduce Minuteman vulnerability? If the U.S. adopted an early launch strategy, what would be the likely Soviet response? If the Soviet Union adopted such a strategy, how would the U.S. respond?

READINGS

James Fallows, National Defense, (New York: Random House) 1981, chapter 6.

James R. Schlesinger, "The Evolution of American Policy Towards the Soviet Union", International Security, v.1 #1, summer 1976.

Bernard Brodie, "The Development of Nuclear Strategy", International Security, v.2 #4, spring 1978.

V. CLOSE CALLS AND MISTAKES

The US missile attack warning system is designed to provide the earliest possible warning of an attack on the US. The warning system has three parts: sensors, computer centers, and command posts. The sensors are designed to detect missile launch or bomber attack, and includes satellites and extensive radar networks. The computer centers process and analyze the sensor data, passing this information to the command posts. At the command posts, the data from the sensors and computers are analyzed and the necessity for action is assessed.

Unfortunately, this system is prone to error. For example, on several occasions, the computer portion of the system has indicated that the US was under attack, when in fact no such threat existed. Assuming that detection systems are never 100% reliable, one may err in two different directions. The first type of error is to make the system too sensitive. An overly sensitive system will almost never miss an actual attack. However, it may frequently give signals indicating attack where there is little evidence to support such a conclusion. The alternative is to make the system less sensitive, so that false alarms rarely occur. This choice leaves the possibility that there will be an attack that the sensors will be unable to detect. Currently, public attention is focused on the number of false alerts, and the possibility that an overly sensitive alert system may provoke a nuclear response to a non-existent attack.

In 1979 and 1980 there were four determinations of a possible threat to North America. In each case, the Commander-in-Chief of the North American Aerospace Defense Command (NORAD) decided that there was a potential threat to North America and called a threat assessment conference, the last step before direct Presidential involvement. One incident was caused by the misinterpretation of the nature of a rocket in a decaying orbit; another resulted from the assumption that simulated data (inadvertently introduced into the NORAD system) were reliable indicators of a massive attack. A third incident was a mistaken response to a Soviet SLBM training launch; the last was caused by a faulty chip in a communications processor computer.

QUESTIONS

What is the nature of the US alert system? What sorts of errors does it make most frequently? How are they caused? If these errors are eliminated, are different errors likely to result? Could a nuclear war start as a result of computer error? human error? What is the command, control, communications, and intelligence (C^3I) system? How is it supposed to function during nuclear war? What are potential problems with this system? What happens to decision-making processes when the "time of travel" (from one country to another) is reduced from 30 minutes to 6 minutes? What effect does the deployment of Soviet SS-20s and US Pershing IIs have on this decision-time?

"U.S. Nuclear Weapons Accidents: Danger in Our Midst", Defense Monitor, Center for Defense Information, vol. X #5.

"Recent False Alerts from the Nation's Missile Attack Warning System", Senate Armed Services Committee, (Washington, D.C.: GPO) 1980.

VI. NEW WEAPONS SYSTEMS AND DEVELOPMENTS

One of the most serious threats to peace is that technology and weapons development will outdistance or dominate arms control efforts. Arms control negotiations may take years to conduct, allowing research and development of new systems to proceed, often at an increased pace. In addition, if one country leads the development of a weapons system, it may be unwilling to forfeit this advantage to secure an arms control agreement.

The decision not to include multiple independently-targetable re-entry vehicles (MIRVs) in SALT I is an example of the difficulty of arms control. The MIRV decision was attributed to three primary factors. First, some scientists and military officials were anxious to determine the technological feasibility of MIRVing a missile. They did not want to ban its development before they tested the technology. The US was also concerned that the Soviet Union would develop ABM capabilities. This development could have endangered the US ICBM force. US officials thought that MIRVing US ICBMs would allow the US to retain the ability to launch a successful retaliatory strike against the Soviet Union. In addition, the US was ahead of the Soviet Union in the development of MIRV technology, and did not want to relinquish this advantage. At this time, arms control advocates felt they had to choose between fighting the proposed ABM, and opposing MIRV. They chose to fight the ABM, and allowed the development and deployment of MIRV'ed missiles. In retrospect, many of these same advocates feel they made the wrong choice.

At present, several new systems are under consideration or development. Some have been justified as bargaining chips for arms control negotiations with the Soviet Union; others are seen as responses to Soviet military and technological advances. In order to understand the current arms race, and the potential for future escalation, it is necessary to comprehend both the nature of these developments, and their potential impact on future negotiations.

QUESTIONS

In general, what are the arguments for and against the development of new weapons systems? What is the historical response to the deployment of new weapons? To what extent are new systems justified as bargaining chips? What are the characteristics of the following systems: the B-1 bomber, the MX missile, Trident II submarine, cruise missile, SS-18 and SS-19 ICBMs, and Typhoon-class submarines? What is the schedule for deployment of each of these systems? How may they threaten future arms control attempts? What are the potential capabilities of these systems?

READINGS

James Fallows, National Defense, chapter 3.

Frank Barnaby, "World Arsenals in 1981", The Bulletin of the Atomic Scientists, August/September 1981.

"Preparing for Nuclear War: President Reagan's Program", Defense Monitor, Center for Defense Information, vol. X #8.

VII. ECONOMIC TRADE-OFFS

If the government could spend at will, choices between military and social expenditures might not be a major issue. However, economic realities preclude this option. Accordingly, the discussion of trade-offs between military and social expenditures proceeds from the assumption that the governmental budget is restricted. However, it should be noted that funding for strategic nuclear weapons represents only about 10% of the annual defense budget. In fact, building nuclear weapons is often cheaper than deploying the equivalent destructive capability in conventional weapons. Thus, a decision to convert from nuclear to conventional weapons might actually increase defense costs.

Advocates of decreased military expenditures argue that every dollar spent on the military diverts a dollar from social expenditures. In addition, there are various analyses of the number of jobs foregone as a result of military expenditures. Money spent on goods and services creates more jobs than money spent on military hardware and weapons stockpiles. For example, durable goods may remain in use for a substantial period of time, and the wages paid to the producer of such goods may subsequently be used to purchase other goods and services. In contrast, money spent on military hardware is spent once, and then the weapons are stored; there is no further cycling of goods or services through the domestic economy. There is also concern that the military and the private sector compete for scarce resources. One phenomenon of this type is the domestic "brain drain". This term refers to the loss of trained technical specialists who move from the civilian to the military sector, often leaving a shortage of talent in that portion of the civilian sector.

QUESTIONS

What is the relationship between military and social expenditures? To what extent do social or civilian expenditures create more jobs than military expenditures? Why? Can "military dollars" be substituted one-for-one for "civilian dollars"? What kinds of effects do military expenditures have on the economy? What effect would a constitutional amendment requiring a balanced budget have on choices between military and social expenditures?

READINGS

John Kenneth Galbraith, "The economics of the arms race--and after", The Bulletin of the Atomic Scientists, June/July 1981.

Marion Anderson, "The Empty Pork Barrel", Employment Research Associates, 1982.

Michael Parenti, "More bucks from the bang", The Progressive, July 28, 1980.

VIII. SOLUTIONS, TREATIES, AND VERIFICATION ISSUES

During the last twenty years, there have been many attempts at arms control, including more than a dozen negotiated treaties and agreements. Many proposals have focused on a particular weapon or system, such as the ABM. Other attempts have included quantitative limits on the number of nuclear missiles, launchers, or warheads that a country may deploy. Key agreements and provisions include:

1963 PARTIAL TEST BAN TREATY (PTBT), which prohibited the testing of nuclear weapons in the atmosphere, in outer space, and under water.

1972 SALT I INTERIM AGREEMENT, which provided for a five year freeze on the total number of ICBM and SLBM launchers for the US and the Soviet Union.

* In September 1977, both countries announced their intent to continue honoring the SALT I agreement, even though it technically expired that fall.

ABM TREATY, a part of SALT I, which limited the deployment of ABM systems by the US and the USSR to two sites. Each country was allowed one site to protect the national capitol, and one to protect an ICBM complex.

* A 1974 protocol to this treaty further limited each party to a single site.

1974 THRESHOLD TEST BAN TREATY (TTBT), which prohibited underground tests of more than 150 kilotons.

* This treaty has not yet been ratified by the United States.

1979 SALT II, which set a ceiling of 2400 on ICBM and SLBM launchers, heavy bombers, and air-to-surface ballistic missiles (ASBMs) capable of a range of more than 600 kilometers. The treaty required a reduction of this ceiling to 2250 by the end of 1981, with decreasing inventories beginning January 1, 1981. It also contained sub-limits on MIRVed missiles, and restrictions on the number of re-entry vehicles allowed on current launchers. A protocol to the treaty contained short-term prohibitions on the deployment of mobile ICBM launchers and the flight-testing of ICBMs from such launchers.

* This treaty has not yet been ratified by the United States.

In addition, several proposals are now under consideration. Key proposals and provisions include:

COMPREHENSIVE TEST BAN TREATY (CTBT)

This treaty would prohibit all nuclear weapons testing, including underground tests of any size. Negotiations on the CTBT were suspended in 1980.

NUCLEAR FREEZE

This proposal exists in various forms. The most common interpretation of the freeze is a "mutual and verifiable freeze on the testing, production, and deployment of nuclear warheads, missiles, and other delivery systems". Others suggest a freeze in deployment, but not testing or production; still others suggest a freeze only after the US has implemented a weapons buildup that will achieve what they consider to be parity with the USSR.

STRATEGIC ARMS REDUCTION TALKS (START)

This proposal, suggested by President Reagan, includes a "Phase I" limitation of 5000 on the total number of warheads deployed by each country. Within this limit, there would be a sub-limit of 2500 on land-based missiles. In Phase II, the parties are to concentrate on an agreement to equalize throw weight, but only on ballistic missiles, where the Soviet Union's forces are concentrated. Bomber throw weight, in which the US leads the Soviet Union, is not to be limited under this agreement.

NO FIRST USE

This proposal includes a declaration by the US that we will not be the first to use nuclear weapons. Such a declaration might be accompanied by a significant change in the US force structure, deemphasizing the use of nuclear weapons. It might also include the removal of 6000-7000 battlefield nuclear weapons from Europe.

In addition, it has been suggested that the US could simply ratify SALT II to begin the next phase of arms control.

VERIFICATION

Many of these proposals raise issues about the verification of arms control agreements. Unless the provisions of treaties and agreements are perceived as verifiable, the chances of domestic acceptance are severely diminished. SALT I and II depend on the national technical means available to each country for verification, and rely on standing consultative commissions to implement the agreements. However, there is concern that national technical means are insufficient, and that the Soviets may be violating these and other arms control agreements. This issue was important in the consideration of the SALT II treaty.

Others argue that this concern is vastly overstated. They claim that it is virtually impossible for either country to make substantive changes in the balance of forces without the other side discovering the attempt. In addition, these analysts emphasize the costs if a country detects treaty violations. For example, it was assumed the US would vastly accelerate its research and development program if it was proven that the Soviets had violated the SALT II treaty.

Both countries are concerned with the question of on-site inspections. The Soviet Union agreed to on-site inspections as part of the Comprehensive Test Ban Treaty negotiations, but the negotiations were never completed. Some analysts claim that the Soviet Union would violate arms control agreements if on-site inspections were not required; others say that the Soviets are concerned that the US would use on-site inspections to conduct espionage activities within the Soviet Union.

QUESTIONS

What attempts have been made at negotiated arms control? What treaties are now in effect? Which ones have expired but are still being observed; have been negotiated but not ratified; are in the process of negotiation; have been proposed by others, but not pursued by the administration? How does SALT differ from START? What are the differences in the various freeze proposals, and between the freeze and no-first-use? What effect would these proposals have on the balance of forces and the theoretical vulnerability of land-based ICBM forces? How comprehensive are these proposals? What are the potential obstacles to ratification or acceptance of these proposals? For each of these proposals, what issues would require verification of compliance? What is the likelihood that cheating could be detected?

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Philip J. Farley, Betty G. Lall, Gerard C. Smith, Herbert Scoville, Jr., and Michael Krepon, "Nuclear Arms Control: Options for the 1980s", *The Arms Control Association*, 1982.

Daniel Ford, Henry Kendall, and Steve Nadis, *Beyond the Freeze: The Road to Nuclear Sanity*, Union of Concerned Scientists (Boston: Beacon Press) 1982.

Raymond Garthoff, "Mutual Deterrence and Strategic Arms Limitation in Soviet Policy, *International Security*, v.3 #1, summer 1978.

"Verification", *Wall Street Journal*, May 20, 1982.

Robert J. Einhorn, "Treaty Compliance", *Foreign Policy*, #45, winter 1981-1982.

Noel Gayler, "How to Break the Momentum of the Nuclear Arms Race", *New York Times Magazine*, April 25, 1982.

APPENDIX 4

The Prompt and Delayed Effects of Nuclear War[29]

The prompt effects of nuclear weapons are the basis for the size of U.S. strategic forces. The delayed effects are equally great, ensuring that these forces remain a more than ample deterrent

by Kevin N. Lewis

The primary purpose of this country's strategic nuclear forces is to deter the U.S.S.R. from launching an attack on the U.S. or its allies. To accomplish that mission the U.S. maintains the constant ability to inflict intolerable damage on the U.S.S.R. The long-range missile and bomber forces of the U.S. have been designed to survive even an all-out surprise attack by the U.S.S.R. in numbers sufficient to deliver a devastating retaliatory counterattack. Since the U.S.S.R. has similar forces, it is considered unlikely that either side would find it advantageous to attack the other. It is this mutual retaliatory potential, or assured-destruction capability, that is widely held to be responsible for the strategically stable military balance between the two superpowers.

Since in this view the avoidance of war depends in part on the integrity of the assured-destruction capability of the U.S., any degradation of that capability would be a grave matter. Accordingly recent assertions by some military analysts that the U.S.S.R. is actively pursuing measures to reduce the effectiveness of an American retaliatory strike have given rise to much concern. Specifically it is alleged that ambitious Russian civil-defense initiatives could create a dangerous strategic asymmetry in the absence of countervailing U.S. efforts. For example, in conjunction with a surprise "counterforce" attack on U.S. land-based missiles the U.S.S.R. could attempt to evacuate its cities, with the projected result that Russian fatalities in an all-out nuclear exchange would be substantially fewer than American ones. In such a situation the U.S. might be inhibited from further escalating hostilities, and the U.S.S.R. would then in various ways be able to impose its will. Even if all-out war were to ensue, the U.S.S.R., it is said, would be able to recover much faster than the U.S. One result of this line of reasoning has been a revival of interest in the moribund American civil-defense program; another has been the consideration of new strategic-missile targeting options designed to defeat the Russian civil-defense program.

Such hypothetical scenarios are based in part on underestimates of the damage the surviving U.S. forces could inflict on the U.S.S.R. Many estimates of this kind include only the easily calculable blast effects of nuclear weapons. They ignore the equally devastating effects of thermal radiation and ionizing radiation. When these additional effects are included in the calculations, it is clear that nuclear war remains an unmitigated mutual disaster, and that no conceivable civil-defense preparations could materially change the prospect. Therefore from an operational military point of view there is no validity to assertions that the U.S. retaliatory capability is "eroding." Moreover, it is extremely unlikely that the situation will change in the foreseeable future.

How is the damage from nuclear war estimated, and what consequences of such a war are routinely excluded from calculations of the damage? In this article I shall compare calculations frequently used to assess "adequate" levels of assured destruction with estimates of the probable wider results of a nuclear exchange between the two superpowers. The more comprehensive analysis shows that neither the U.S. nor the U.S.S.R. needs to be concerned about the integrity of its retaliatory capability. Although much of the current debate on the gravity of the Russian threat tends to ignore this fact, there can be no conceivable doubt that all-out war remains a losing proposition for both sides. Credible deterrence of course relies on many factors other than the ability to conduct a massive retaliatory attack. It is in the interest of all parties, however, that the notion of "winning" an all-out nuclear war, in the sense of one side's being able to improve its relative position at an acceptable cost, be dismissed from the strategic debate, and that the full consequences of such a calamitous event be brought to public attention.

Specific criteria of retaliatory effectiveness were first established under the direction of Secretary of Defense Robert S. McNamara in the early 1960's. Up to that time strategic military planners lacked any formal quantitative standards for determining the appropriate levels of U.S. retaliatory forces. Secretary McNamara therefore advanced the concept of assured destruction, arguing that the destruction of between 20 and 25 percent of the U.S.S.R.'s population and at least 50 percent of its industrial capacity would constitute unacceptable damage in the eyes of that country's leaders. By establishing these measures McNamara was better able to coordinate Air Force and Navy planning, to match strategic military requirements with existing force structures and to eliminate programs that were superfluous. Although the task of defining a certain level of damage had a political purpose, namely to threaten the government of the U.S.S.R. with intolerable de-

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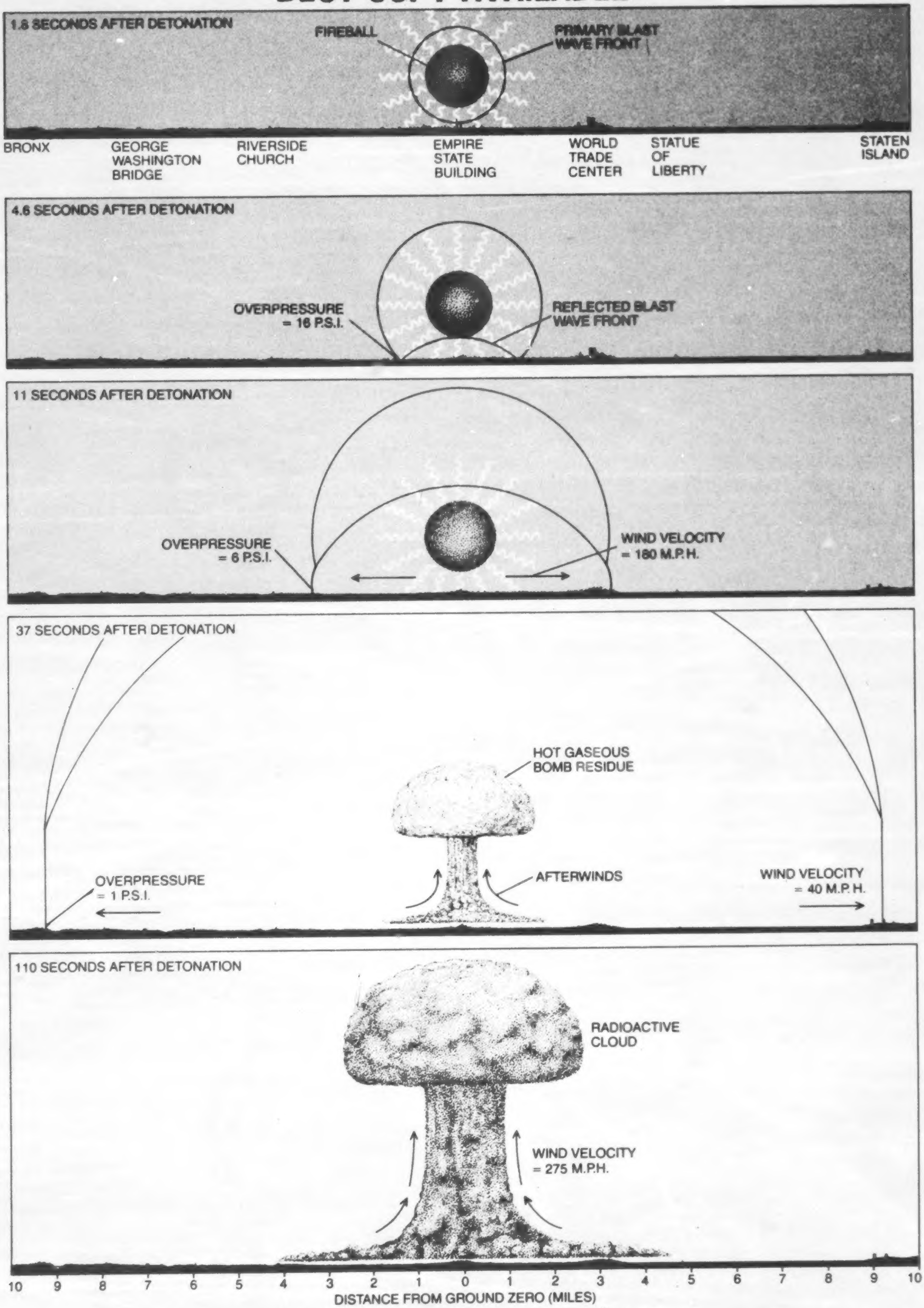
1.8 SECONDS AFTER DETONATION
FIREBALL
PRIMARY BLAST WAVE FRONT
BRONX
GEORGE WASHINGTON BRIDGE
RIVERSIDE CHURCH
EMPIRE STATE BUILDING
WORLD TRADE CENTER
STATUE OF LIBERTY
STATEN ISLAND
4.6 SECONDS AFTER DETONATION
OVERPRESSURE = 16 P.S.I.
REFLECTED BLAST WAVE FRONT
11 SECONDS AFTER DETONATION
OVERPRESSURE = 6 P.S.I.
WIND VELOCITY = 180 M.P.H.
37 SECONDS AFTER DETONATION
HOT GASEOUS BOMB RESIDUE
AFTERWINDS
OVERPRESSURE = 1 P.S.I.
WIND VELOCITY = 40 M.P.H.
110 SECONDS AFTER DETONATION
RADIOACTIVE CLOUD
WIND VELOCITY = 275 M.P.H.
10 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10
DISTANCE FROM GROUND ZERO (MILES)

struction, the specific percentages chosen reflected the capabilities of the U.S. strategic forces programmed at that time. The required levels of destruction were also based to some extent on the characteristics of the particular target system represented by the U.S.S.R.

The population and economic resources of the U.S.S.R. are concentrated in a remarkably small number of major urban centers. About a third of the population and nearly two-thirds of the industrial capacity are concentrated in the country's 200 largest cities. Nuclear attacks on additional cities would not appreciably increase the retaliatory damage (except for the delayed effects of radioactive fallout). McNamara's criterion of assured destruction could therefore be loosely translated into the ability to destroy the 200 largest cities in the U.S.S.R.

Given this assumption, U.S. force requirements could be set by determining the number of nuclear warheads needed to destroy the social and economic targets of importance in those 200 cities. Target planning is sensitive to many operational factors, such as the composition and layout of cities, but above all it calls for predicting accurately how the local population will be affected by the lethal effects of nuclear explosions. In actual practice retaliatory damage is predicted by matching the physical properties of nuclear explosions with the relevant target characteristics on a city-by-city basis. In calculating such damage levels U.S. planners have at their disposal a large store of information on each target, sophisticated analytical techniques and an advanced data-processing capability. The results of these detailed calculations can be approximated fairly well, however, with the aid of some simple procedures.

The yield of a nuclear weapon is usually described in terms of the quantity of chemical explosive required to release an equivalent amount of energy; a nuclear weapon is said to have the power of kilotons (thousands of tons) or megatons (millions of tons) of TNT. As in a chemical explosion, the energy from a nuclear explosion is generated very quickly in a small volume. When the nuclear explosion is set off in the air, the energy released instantaneously vaporizes the components of the warhead, creating a hot, rapidly expanding fireball. The explosion gives rise to two prompt effects that in an attack on a city can be devastating. First, as the fireball expands it sends a shock wave through the surrounding medium. The shock wave, which travels away from the point of the explosion at supersonic speeds, does blast damage to structures and people. The hot fireball also radiates thermal energy, mainly photons in the visible and infrared regions of the electromagnetic spectrum, which can cause burns and ignite materials that are not protected by some kind of opaque screen. Roughly half of the weapon's energy is eventually converted into mechanical blast motions and about a third is released in the form of thermal radiation. The rest of the energy is represented by prompt nuclear radiation and delayed thermal and nuclear radiation, none of which are treated as being important in assured-destruction planning but all of which nonetheless add to the destructiveness of a nuclear attack.

The mechanical motions of a nuclear explosion are analogous to those of a tidal wave. The shock front is literally a wall of compressed air. As it passes, structures are exposed to a nearly instantaneous rise in the local atmospheric pressure, and they may be crushed. Following the shock front are strong winds analogous to the water currents that follow a moving ocean wave. The forces resulting from these winds may also lead to the collapse of structures in the target area. Depending on their shape and construction, buildings may be vulnerable either to the shock wave or to the winds that follow it or to both. The "hardness" of a target (its ability to withstand the destructive effect of the shock wave) is generally described in terms of the induced peak "overpressure" (in pounds per square inch above atmospheric pressure) at which the target is destroyed.

Thermal radiation can lead directly to flash-burn casualties and indirectly (through the ignition of nearby materials) to flame-burn casualties, superposing both effects on blast casualties. The extent of such damage depends on both the power of the radiant energy delivered (usually measured in calories per square centimeter) and the period over which the energy is delivered. Destructive blast effects decay with distance faster than thermal effects. Therefore under ideal conditions a nuclear explosion can do substantial incendiary damage well beyond the area devastated by blast. The thermal damage, however, is much influenced by external factors, including the presence of clouds or of snow cover, the relative transparency of the atmosphere and the composition of the target. Hence thermal effects are far less predictable than direct blast effects.

Since retaliatory forces are planned on the basis of assured damage, the consequences of an attack are typically calculated only on the basis of the more predictable blast effects. Consider the problem of allocating a suitable "package" of nuclear weapons to an urban area after a review of the targets within that city. Aim points for each weapon are selected in such a way as to ensure that the desired blast effects will cover all the targets. If the targets are close enough together, a single warhead may suffice. If the targets are dispersed or hardened, it may be preferable to allocate more than one weapon to a target area, as opposed to increasing the yield of a single weapon. This approach guards against the failure of a single large warhead, which would leave a tar-

THE PROMPT EFFECTS of the explosion of a one-megaton nuclear warhead detonated at a height of 6,500 feet over the heart of New York are depicted chronologically in the sequence of scenes on the opposite page. Immediately after such a detonation an extremely hot, luminous fireball would form. The fireball would emit intense thermal radiation (*color*), capable of causing skin burns and starting fires at a considerable distance. The explosion would also give rise to a destructive blast wave, which would move away from the fireball at supersonic speed; at 1.8 seconds after the detonation, for example, the front of the blast wave (*black circle*) would be roughly half a mile ahead of the fireball. In addition the nuclear processes responsible for the explosion would be accompanied by the emission of hard radiation, mainly gamma rays and neutrons (*wavy white lines*), which would have enough range in air to reach the ground in the midtown area. When the primary blast wave from the explosion hit the ground, another shock wave would be caused by reflection. At a certain distance from ground zero (depending on the height of the explosion and the energy yield of the weapon) the primary and reflected wave fronts would fuse near the ground to form a single reinforced Mach front; in the case of a one-megaton warhead detonated at 6,500 feet the Mach effect would begin some 4.6 seconds after detonation at a distance of 1.3 miles from ground zero. At that point the overpressure (that is, the air pressure above ambient atmospheric pressure) would be 16 pounds per square inch (p.s.i.). At 11 seconds after detonation the Mach front would have moved outward to 3.2 miles from ground zero, the overpressure at the Mach front would be 6 p.s.i. and the velocity of the wind just behind the front would be approximately 180 miles per hour; appreciable amounts of thermal radiation and nuclear radiation would continue to reach the ground. At 37 seconds after detonation the Mach front would be nearly 9.5 miles from ground zero, the overpressure at the front would be 1 p.s.i. and the wind velocity behind the front would be 40 miles per hour. (Glass would be broken at overpressures down to .5 p.s.i.) Although thermal radiation would no longer be significant, gamma rays would still reach the ground in potentially lethal amounts. The fireball would no longer be luminous, but it would still be very hot, and it would therefore rise rapidly, causing air to be drawn inward and upward, producing strong air currents called afterwinds. These winds would raise dirt and debris from the city to form the stem of what would eventually become the characteristic mushroom cloud. By 110 seconds after detonation the hot residue of the fireball, while continuing to rise, would have begun to expand and cool. As a result the vaporized fission products and other weapon residues would condense to form a cloud of radioactive particles. By this time the cloud would have risen to a height of seven miles. The maximum height attained by the cloud (after 10 minutes) would be about 14 miles. Ultimately the particles in the cloud would be dispersed by the wind, and unless there were precipitation there would probably be no early (or local) fallout of radioactive material.

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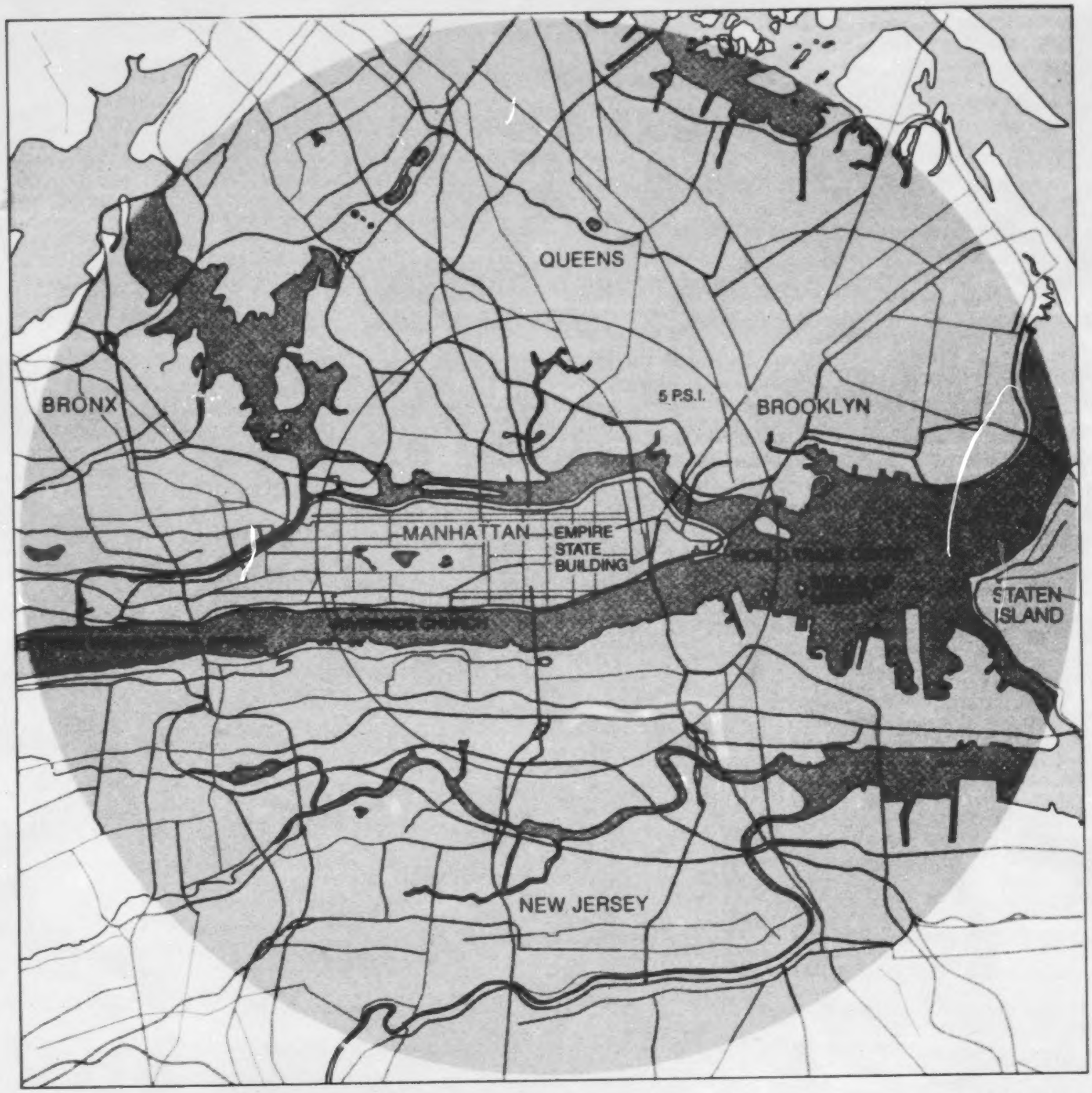
get "uncovered." It also reflects the fact that few industrial and military complexes are sufficiently concentrated or have the right shape to be attacked by a single weapon of the type that currently constitutes the bulk of the U.S. strategic arsenal.

Each city has a unique set of target characteristics, but some simple rules make it possible to predict damage and fatalities. In general any structure not specifically designed for blast resistance would be destroyed if it were exposed to an overpressure of five or more pounds per square inch (p.s.i.) above the ambient atmospheric pressure of some 15 p.s.i., and those structures that would not actually collapse would typically be damaged beyond repair. Some reinforced buildings (and heavy equipment inside them) could withstand an overpressure of 40 p.s.i. or more, but if these targets were considered important, an attacker could lower the height at which his weapons were set to explode or could aim his weapons (or allocate new warheads) to achieve the desired effects. Still, as a rule of thumb an overpressure of 5 p.s.i. is considered sufficient to destroy most structures.

The human body can endure a far more intense blast than most buildings. Therefore in a nuclear attack most of



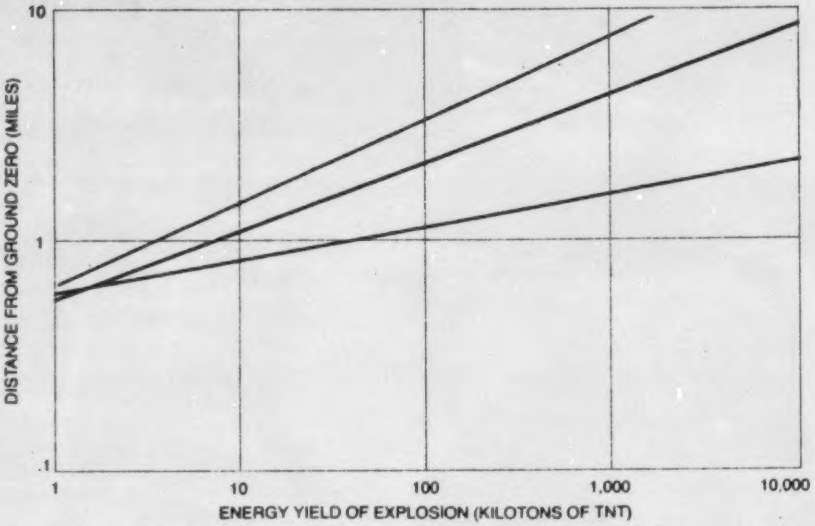
LETHAL AREA is defined by U.S. nuclear-war planners as the circular region within which the number of survivors of a nuclear explosion equals the number of fatalities outside the region. This simplifying assumption makes it possible to arrive at an estimate of the prompt fatalities resulting from a nuclear explosion by multiplying the lethal area by the population density (assuming that the population density over the entire area is uniform). As a general rule the lethal area is considered to extend roughly to the 5-p.s.i. overpressure contour, which for the one-megaton airburst represented on page 4 corresponds to a circular area with a radius of 4.3 miles (*area within black circle*). The lethal-area concept excludes several important (if less predictable) delayed effects of nuclear explosions, such as fires and radioactive fallout. On a clear day, for example, a one-megaton airburst could ignite fires as much as 10 miles away. If these fires were to consolidate into a mass fire, the entire region within that range (*colored area*) would be devastated, enlarging the lethal area fivefold.

the blast casualties would be caused by indirect effects. The bulk of the population would be at risk from being inside or near collapsing buildings, from being hit by debris thrown by the shock wave or from being hurled into an immobile surface. Thermal effects would also cause many fatalities within a certain range, regardless of external conditions. In estimating fatalities the simplifying concept of the "lethal area" is often used. Based on theoretical and empirical data developed by the Atomic Energy Commission in the 1950's, the lethal area is defined as the circular region within which the number of survivors would equal the number of fatalities outside the circle, assuming that the population density over the entire area is uniform.

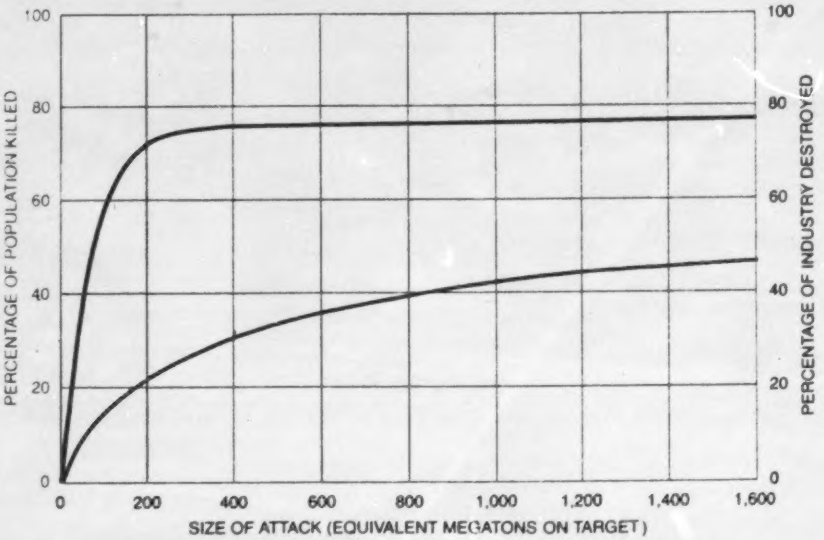
To simplify the calculations the estimated fatalities are redistributed, so that planners consider everyone within the circle to be a fatality and no one outside the circle to be a fatality. An estimate of prompt fatalities is then made by multiplying the lethal area by the population density. The experience of Hiroshima and Nagasaki and also test data indicate that for weapons in the range of 20 kilotons the lethal area extends roughly to the contour within which there is an overpressure of 5 p.s.i. Hence coverage by that overpressure is considered a satisfactory standard for calculating both the fatalities and the economic destructiveness of nuclear explosions.

Nuclear weapons will generate an overpressure of 5 p.s.i. to a distance proportional to the cube root of their yield. For this reason larger weapons are said to distribute their destructive power less efficiently than smaller ones. For example, a 100-kiloton bomb will generate an overpressure of 5 p.s.i. to a range of about two miles. Yet a warhead with 10 times the explosive yield (one megaton) will generate the same overpressure to only about twice that distance. In recognition of the inherently greater efficiency of smaller weapons, a scaled measure known as equivalent megatonnage, defined as the yield of a bomb in megatons raised to the two-thirds power, is considered a better index of countercity capability than the unadjusted yield in megatons. It was calculated by McNamara's systems-analysis staff in the 1960's that the reliable delivery of 400 equivalent megatons would kill 30 percent of the population of the U.S.S.R. and destroy 75 percent of the industrial capacity; more recently the population damage and industrial damage have been estimated to be closer to 35 and 70 percent.

In actuality these damage levels are the lowest that would result from nuclear explosions, since they are typically calculated on the basis of the predictable "prompt" effects described above. When delayed effects (fires, fallout and



TYPICAL RANGES to which three different harmful effects of nuclear weapons extend are represented here for a typical airburst as a function of the energy yield of the explosion. The colored line shows the distance to which thermal radiation can cause second-degree skin burns and ignite fires, creating the risk of a mass fire. The black line measures the radius of the 5-p.s.i. overpressure circle, within which the passage of the blast wave front, followed by 160-mile-per-hour winds, would cause massive urban destruction and a high percentage of fatalities. The gray line gives the range to which prompt nuclear radiation from the explosion would result in 100 percent fatalities. It is evident that under favorable weather conditions the destructive thermal effects of such an explosion could reach well beyond the area of major blast destruction. Prompt nuclear radiation, on the other hand, is clearly not an important damage mechanism for strategic nuclear weapons (which have explosive yields of anywhere from a few tens of kilotons to many megatons), since the areas covered by deadly radiation would also be exposed to severe blast and thermal effects. It is only at much lower yields (on the order of a kiloton or less) that prompt nuclear radiation becomes an important lethal mechanism; that relation in fact is the basic principle of the enhanced-radiation weapon, or neutron bomb.



ASSURED-DESTRUCTION CRITERION, relied on by U.S. strategic planners to determine the retaliatory potential needed by U.S. nuclear forces to deter a surprise attack by the U.S.S.R., is calibrated here in terms of the number of delivered equivalent megatons it would take to destroy key population centers and industrial targets in the U.S.S.R. (Equivalent megatons are defined as the explosive yield of a nuclear weapon raised to the 2/3 power.) Given the decreasing value of adding extra equivalent megatons to such a retaliatory attack, it is evident from these curves that the delivery on target of some 400 equivalent megatons would be more than adequate to achieve assured destruction. Population damage (*color curve*) was estimated in terms of fatalities only; industrial damage (*black curve*) was determined by calculating the "manufacturing value added" destroyed during a U.S. retaliatory attack on the U.S.S.R. (Manufacturing value added is the incremental value imparted to raw materials in any industrial process.)

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so on) are introduced, the damage estimates become much higher. The delayed effects also ensure that even if the blast-damage levels cited in assured-destruction definitions were not reached, an all-out nuclear war would still result in the devastation of the combatant countries.

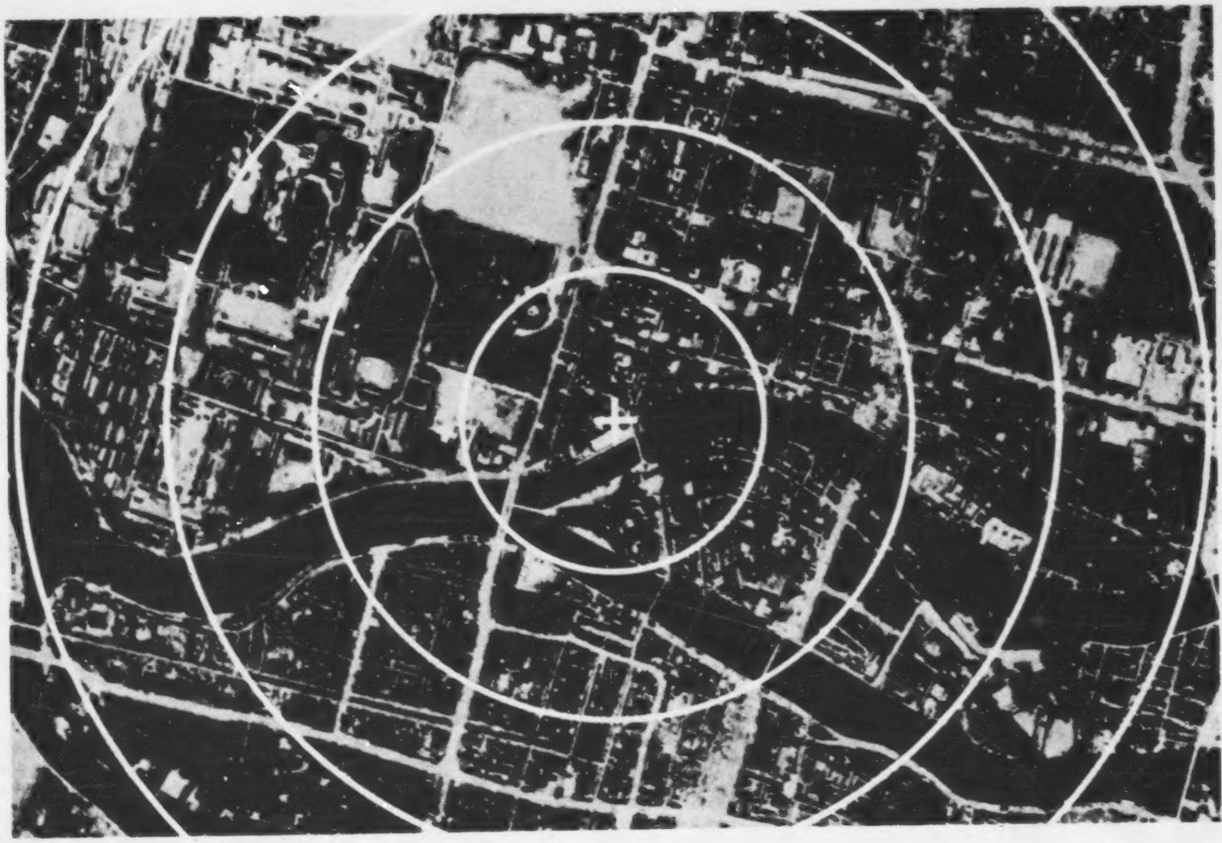
Prompt and delayed nuclear-weapons effects can be contrasted by considering an attack on a typical urban target, for example the greater Boston metropolitan area. The detonation of 10 one-megaton warheads, aimed at local economic and military targets, would generate an overpressure of 5 p.s.i. over more than 500 square miles. More than 1.3 million people would be killed by the prompt blast and thermal effects of the explosions, and more than 80 percent of the area's industrial capacity would be destroyed. It is likely that the secondary effects of the explosions, particularly fires and fallout, would increase these totals.

If conditions were favorable to the attack, the most devastating effect might be incendiary. Under certain weather conditions each one-megaton burst could ignite fires as much as 10 miles away. In such an attack a fire threat would presumably exist throughout much of eastern Massachusetts. Flash-induced fires would be joined by blast-triggered fires from toppled furnaces, stoves and boilers. Scattered debris and ruptured tanks and pipelines would add fuel to the fires. Firebreaks would be bridged by materials hurled by the blast. After the attack the suppression of possibly hundreds of small fires per acre would be a monumental task; water mains would be shattered and firefighting equipment and crews would be destroyed or disabled. In Hiroshima some 70 percent of the city's firefighting equipment was crushed in the collapse of firehouses and 80 percent of the firemen did not report to their posts.

Depending on weather conditions and the characteristics of the target area (particularly the density of flammable structures), the many individual fires might consolidate into one of two types of mass fire: a firestorm or a conflagration. A firestorm is driven by a strong vertical updraft of heated air, which is replaced by cool air sucked in from the periphery of the fire. A conflagration is driven in addition by a strong ground wind that was present before the attack. Whereas a firestorm continues only as long as its centripetal winds do, a conflagration can continue as long as fuel is available.

The consequence of a mass fire is total devastation within the affected area. The temperatures in a mass fire can exceed 1,000 degrees Celsius, a temperature higher than that necessary to melt glass and metal and to burn ordinarily fireproof materials. In Hiroshima an atomic bomb with a yield on the order of 15 kilotons caused a firestorm that lasted for six hours, totally destroying 4.4 square miles of the city. American cities are constructed of materials that are more fire-resistant than those in Hiroshima; on the other hand, American cities are more built up and more fuels, notably gasoline and heating oil, are available to feed fires. Most important, the yields of many modern strategic nuclear weapons exceed those exploded at Hiroshima and Nagasaki by two or more orders of magnitude. In addition much of the area under attack would be exposed to thermal radiation from more than one fireball.

Blast shelters would provide little protection against large fires. The survival of the occupants of such a shelter would depend critically on the temperature and humidity inside the shelter, and if mass fires were to start, the problem of maintaining a shelter environment in which people could survive would be aggravated beyond solution. Moreover, unless there was an independent supply of oxygen for each shelter, carbon monoxide and other toxic gases generated by



HIROSHIMA is seen from directly above in these U.S. Air Force reconnaissance photographs made before (*left*) and after (*right*) the atomic bombing of that city on August 6, 1945. The cross marks ground zero, the point on the ground directly under the explosion. The

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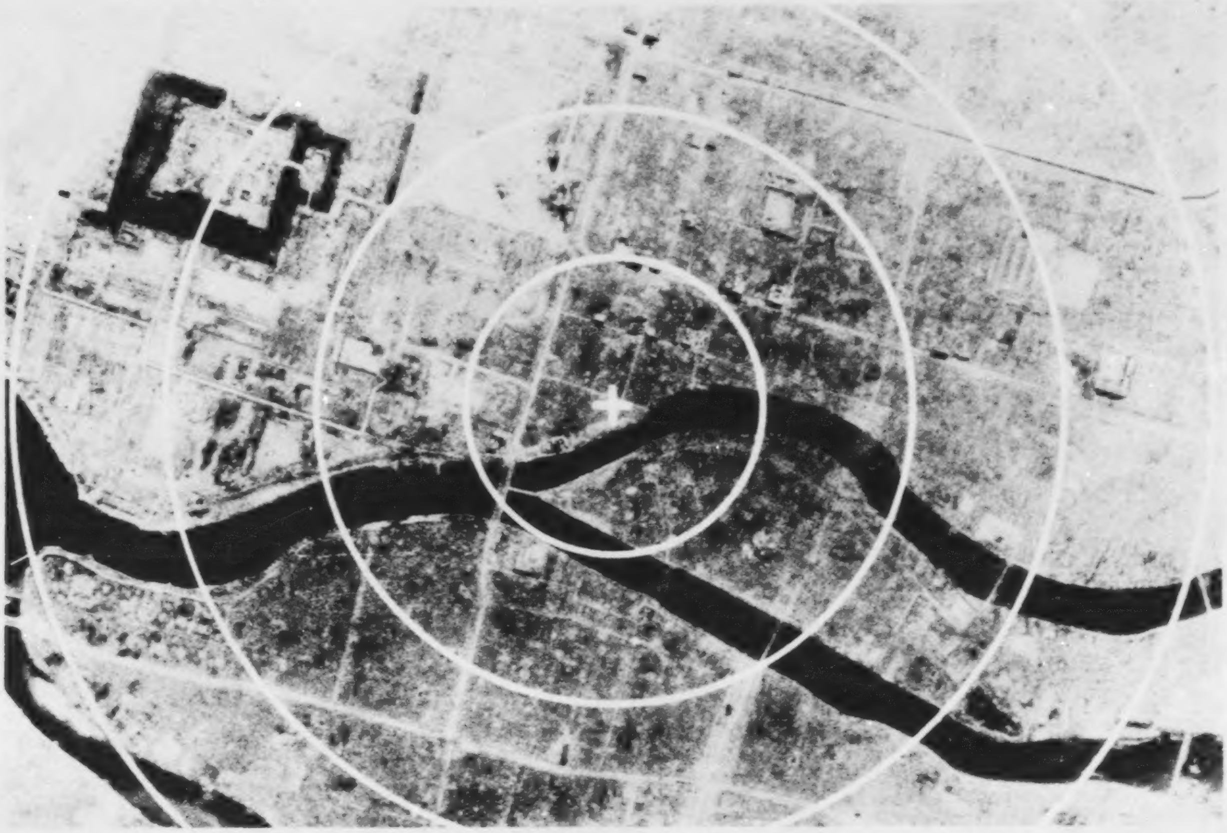
the fire could be deadly to the occupants. The heating of shelters, both by flames and by heated rubble (which could remain intolerably hot for days after the end of a fire), would jeopardize the occupants of shelters with an isolated atmosphere. In Dresden, where a firestorm ignited by chemical bombs killed more than 100,000 people in 1945, only those inhabitants who had left their shelters before the firestorm began were able to survive the twin threats of noxious gases and shelter heating.

After a nuclear attack many people would be disabled, trapped in wrecked buildings or prevented from fleeing the city because the streets were blocked by debris or fire. If mass fires were to form, which seems to be the probable result of multiple megaton bursts, the survivors among those who had escaped prompt incapacitation might be few. If mass fires were to begin in the Boston area, for example, the number of fatalities could be increased by 500,000.

Another factor not included in many assured-destruction calculations is radioactive fallout. Fallout results from the condensation of the radioactive byproducts of a nuclear explosion on materials fused by the intense heat of the fireball and (to a much smaller extent) from the conversion of nonradioactive materials into radioactive ones by the absorption of neutrons from the nuclear reactions of the explosion. If a nuclear weapon were to be exploded at or near the earth's surface, fallout would be an acute threat. Large amounts of debris would be scooped up into the rising cloud, later to fall out (or more likely be washed out) of the cloud in lethal amounts for hundreds of miles downwind. A dose of ionizing radiation measuring between 400 and 500 rems (an index of the biological effects of different types of radiation on man) delivered over a period of several days would kill half of the people who had been exposed. A dose of between 200 and 300 rems would kill somewhat fewer than 20 percent (assuming prompt medical treatment), but severe radiation-related blood symptoms, including diminished immunological response, could add extra fatalities by contributing to lethal infections. If 10 one-megaton weapons were exploded at ground level (to maximize fallout rather than blast and thermal effects), as many as a million New England residents who were not exposed to the immediate blast and thermal effects of the nuclear explosions would be subjected to dangerous levels of radiation. Even with optimistic assumptions about the availability of shelter and provisions, the fallout fatalities that would be added to the Boston-area toll could be as many as 500,000. An attack of this type might well mix airbursts and ground bursts to create maximum levels of both kinds of damage.

The number of fatalities from fire and radiation would grow steadily after such an attack, in part because medical facilities and personnel would be destroyed. Burn victims would present an exceptional medical problem, since serious burn cases require intensive and immediate treatment if they are to survive. The ability of any medical system to handle large numbers of such casualties is limited even in peacetime. The influx of some 50 survivors of the collision of two jet airliners on Tenerife in the Canary Islands a few years ago put a strain on burn centers in the U.S., which have a maximum capacity of about 130 patients. After a nuclear attack, of course, the number of burn cases would be orders of magnitude greater, and access to medical treatment would be far more difficult.

Existing medical services would be further burdened by the incidence of injuries well beyond areas of widespread mortality. The danger of injury from projected missiles (mainly shards of glass from shattered windows) would exist more than eight miles out from the



concentric circles are at 1,000-foot intervals. The firestorm following the prompt effects of the explosion lasted for about six hours and totally destroyed 4.4 square miles of the city. The explosive yield of the weapon that caused this devastation was on the order of 15 kilotons.

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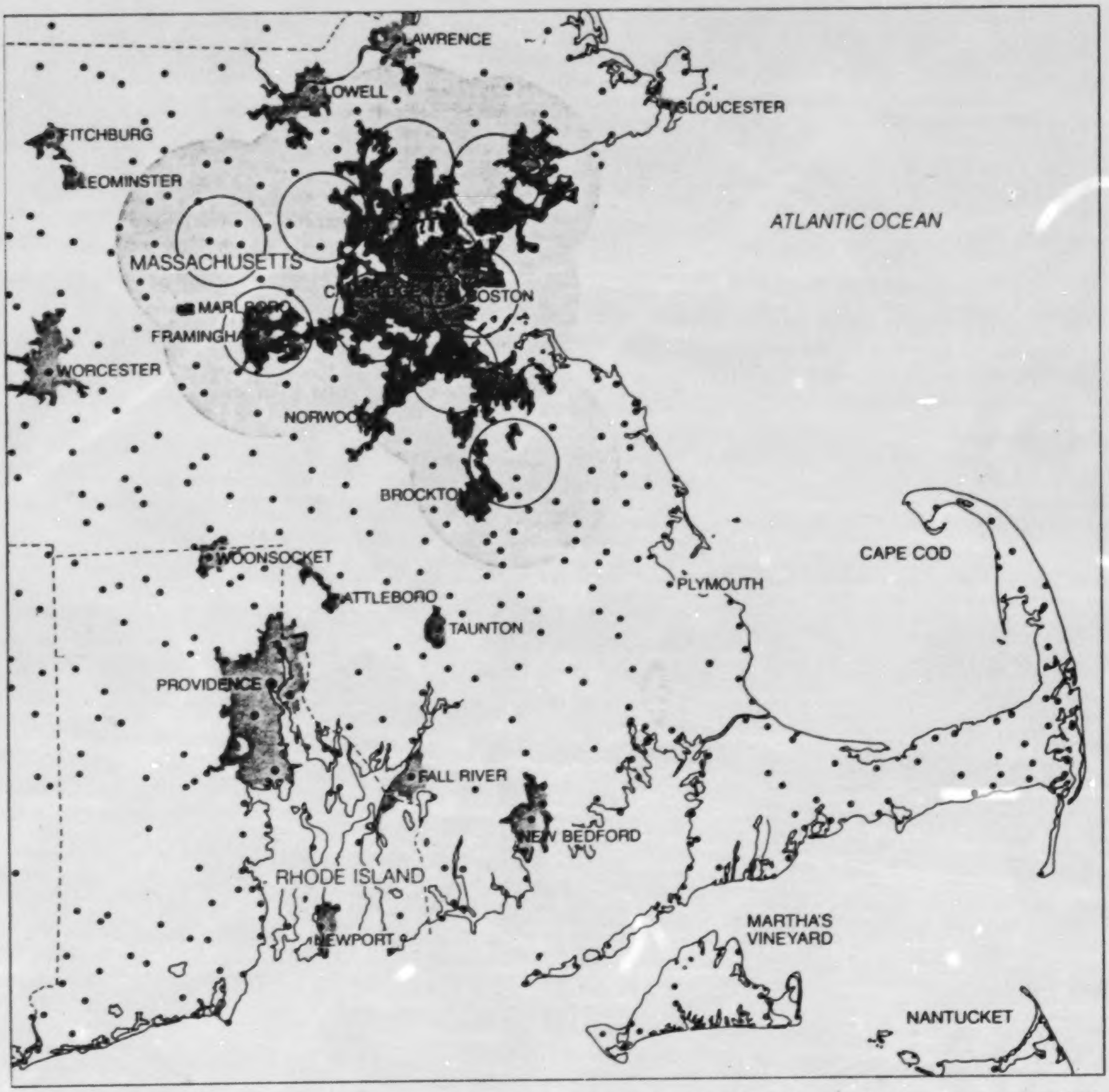
center of a one-megaton blast, and severe burns could be common out to nine miles, depending on weather conditions. Many victims of burns, radiation sickness and other mortal injuries who did not die immediately would require intensive (but under the circumstances unavailable) medical care. The management of less severely injured people and the very young, the very old and those with special medical needs would be complicated by the scarcity of food, shelter and medicine.

The survivors of an all-out nuclear attack would include many who would be permanently incapacitated by crippling injuries, blindness and other causes. Any medical effort would be further degraded by the destruction of public-health facilities and personnel, the proliferation of disease-causing organisms (which tend to survive high radiation levels) and other difficulties, such as the seemingly insoluble problem of disposing of the dead. The total regional casualties following an attack on the Boston area with both airburst and groundburst nuclear weapons could well exceed two million dead, with roughly the same number wounded or sick.

The assured-destruction concept also ignores certain strategic issues. It is typically argued that the U.S.S.R. is pursuing two types of program that would enable it to blunt the effectiveness of a U.S. retaliatory attack. The first program seeks to reduce the number of U.S. warheads arriving at their targets by de-



HYPOTHETICAL ATTACK on the greater Boston metropolitan area, which is outlined on these two pages, serves to contrast the prompt and delayed effects of multiple nuclear explosions. In both cases shown the attack consists of the detonation of 10 one-megaton nuclear warheads, which are aimed at local economic and military targets. In the illustration at the left it has been assumed that all the weapons have been detonated at an altitude that has been selected to maximize blast and thermal effects. Black circular outlines in the illustration correspond to regions exposed to an overpressure of at least 5 p.s.i.; each of these areas is 4.3 miles in radius. The colored areas represent the regions exposed to severe fire and burn risk on a clear day; each area in this case has a radius of 10 miles. The principal delayed effect of the attack suggested by the illustration is the risk of a regionwide firestorm or conflagration, which could add 500,000 fatalities to the assured-destruction estimate of 1.3 million killed by the prompt blast and thermal effects of the explosions. In the illustration

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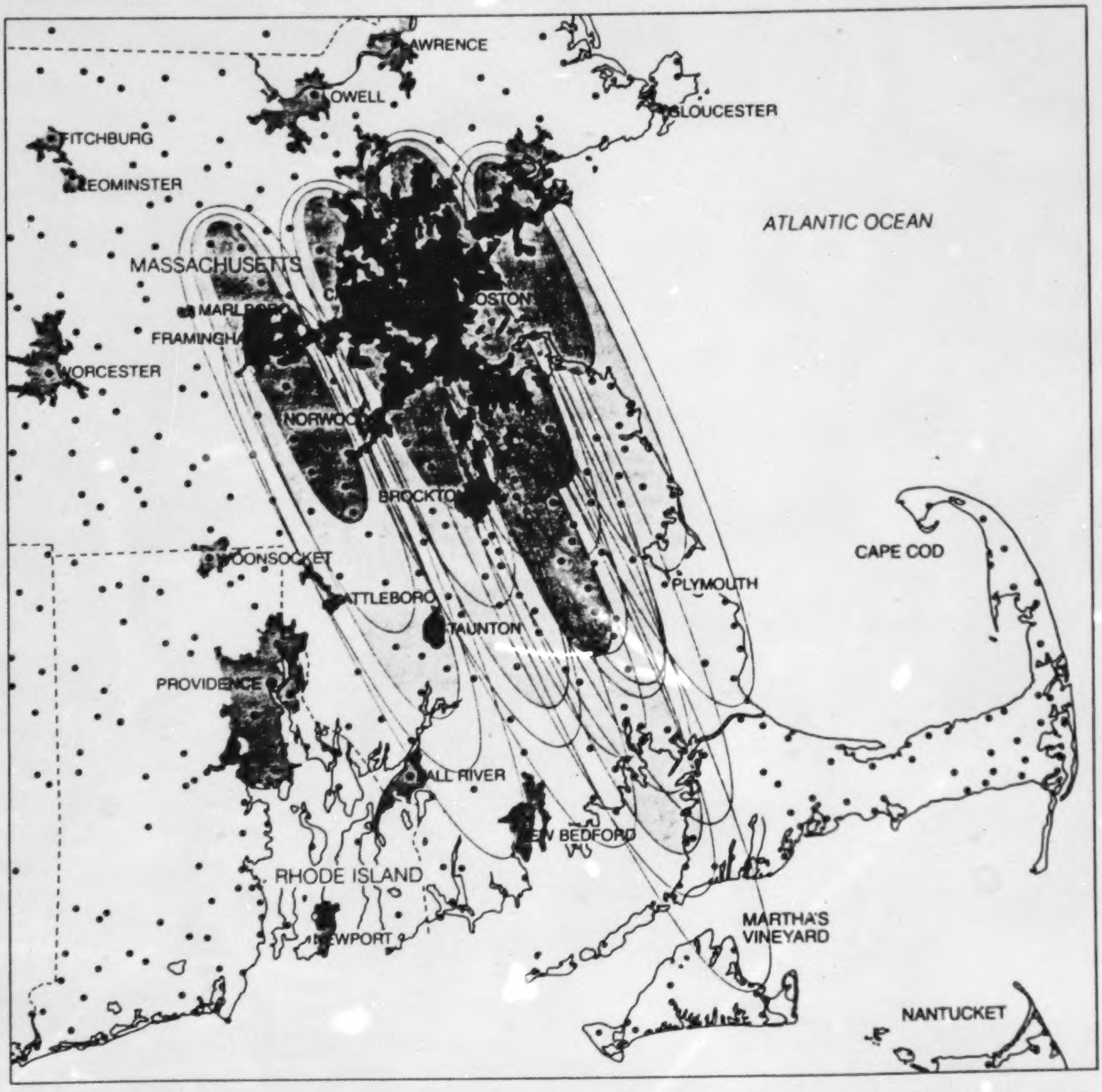
stroying U.S. strategic forces in a surprise attack and by intercepting as many surviving warheads as possible before they reach their targets in the U.S.S.R. The second program seeks to minimize the damage done by arriving U.S. weapons by evacuating urban residents and by dispersing and hardening industrial sites. Because the Russians could thereby "deny" important urban and economic targets to U.S. attack it is maintained that U.S. forces would fail to satisfy the assured-destruction damage levels, and that the U.S.S.R. would retain the industrial base, personnel and administration necessary for a rapid postwar recovery.

In spite of the alleged success of the U.S.S.R. in these endeavors, neither strategy could effectively reduce the devastation of an all-out nuclear war. Furthermore, neither effort would appreciably enhance the potential of the U.S.S.R. for recovery. On the contrary, such schemes only appear to reduce U.S. retaliatory capabilities in the perspective of the narrow and arbitrary definition of assured destruction discussed above.

Such analyses ignore the fact that even under the worst circumstances the U.S. would be able to mount a more than adequate retaliatory attack. Any Russian plan to degrade the U.S. assured-destruction capability would face the formidable task of reducing U.S. forces substantially below the level of 400 deliverable equivalent megatons. (Actually the task might be even more



at the right it has been assumed that all 10 of the warheads have been detonated at ground level in order to maximize the effects of radioactive fallout. (Typical January wind patterns have been assumed in drawing the contours.) The dark-colored areas are those that are covered by an amount of radiation that would be fatal to at least 80 percent of the exposed population. The medium-colored areas are those in which at least 50 percent of the exposed population would die of radiation sickness. The light-colored areas are the probable extent of the region in which clinical radiation symptoms would be evident in much of the exposed population, resulting in perhaps 20 percent fatalities. (Presumably the survivors would also be subjected to the effects of additional long-term radioactive fallout from attacks on neighboring regions.) The total number of casualties in the Boston region following an attack that made use of a suitable combination of airburst and ground-burst nuclear weapons could well exceed two million dead, with approximately the same number wounded or sick.

difficult, because a well-planned American attack of even 200 equivalent megatons could still promptly kill a fifth of the U.S.S.R.'s population and destroy more than two-thirds of its industry, thereby satisfying the requirements of assured destruction.)

It is extremely unlikely that a preemptive Russian first strike could achieve this goal. For one thing, 400 equivalent megatons is only a fraction of the current U.S. nuclear arsenal. More than half of the current U.S. arsenal of more than 6,000 equivalent megatons is carried by missile-launching submarines on station, by bombers on alert at Strategic Air Command bases and by silo-based missiles, all of which are capable of going into action within a few minutes of a Presidential order. The rest of the U.S. strategic forces consist mainly of bombers not on alert and submarines in port for maintenance. If a Russian surprise attack were to destroy many land-based U.S. missiles in their silos and all the nonalert bombers and submarines, more than 2,000 equivalent megatons would remain available for retaliatory action. Even if an unexpectedly large number of U.S. weapons were to malfunction or to be destroyed in flight, more than 1,500 equivalent megatons could still be delivered with high confidence. These figures assume "worst case" conditions from a U.S. perspective: if some warning were available prior to such a Russian attack, extra bombers and submarines could be alerted and the number of deliverable equivalent megatons would more than double.

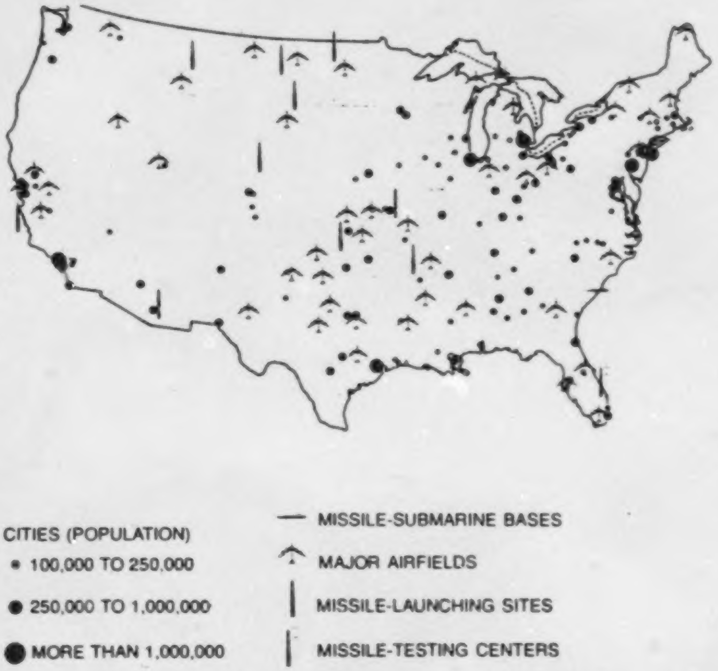
Because of the availability of what are sometimes described as "overkill" forces any effort to reduce the numbers or effectiveness of the arriving U.S. warheads is bound to fail. For example, Moscow is protected by an anti-ballistic-missile (ABM) system that is limited by treaty to 100 missile launchers. (Currently only 64 missiles are deployed in that system.) In the event of a missile attack those missiles could destroy a certain fraction of the incoming missiles. U.S. planners could easily compensate for this potential attrition by several strategies, one of which would be to allocate extra warheads to the "Moscow package" based on generous theoretical assumptions about the effectiveness of the Moscow ABM system.

The assured-destruction criterion implicitly assumes what may be the least probable scenario for a general nuclear war. It is extremely unlikely that an all-out war would begin with a massive surprise attack by either side on the other side's cities. Such a war would more probably follow an escalating crisis that might begin with limited nuclear strikes on military targets. These alternative scenarios imply that city populations would have ample warning of a possible or probable nuclear attack, with the result that evacuation and other tactics for reducing damage could be pursued. If this were to be the situation, the character of the city population would clearly have changed by the time of an attack. Since assured destruction is calculated according to peacetime population densities and the calculations rely on certain assumptions about the disposition of city dwellers and workers on a day-to-day basis, the programmed fatality levels may not be reached under realistic circumstances.

The assured-destruction criterion also assumes that a general nuclear war would consist of a single massive "countervalue" strike: a strike against both military and economic targets. Countervalue strikes might well, however, remain at a relatively low level of intensity for some time. A limited countervalue exchange might consist of attacks on industrial locations away from large cities in order to discourage escalation to attacks with the largest possible number of fatalities. (The Russians in particular have built some key installations in remote areas, where they could be attacked with a relatively low level of fatalities.) Strikes against cities might be preceded by a warning or an ultimatum, which would clearly encourage evacuation. A general war might even begin with a slow campaign of "city-trading." In other words, virtually any change in assumptions radically alters the context of the assured-destruction scenario and casts doubt on the accuracy of fatality estimates.

In fact, except in the circumstances of certain specialized scenarios, there will always be an opportunity for a country to evacuate its urban centers to some extent, regardless of the degree to which the country has prepared for such evacuation. (For example, on September 1, 2 and 3, 1939, the British government evacuated some 1.5 million women and children from Britain's major cities, and in the same three days an additional two million people moved out on their own initiative.) The wide availability of private-automobile transport in the U.S. probably more than compensates for any current Russian evacuation plans and training.

Nevertheless, allegations of evacuation planning in the U.S.S.R. have inspired much concern in the U.S. According to a recent report of the Central Intelligence Agency, if the Russians were to have at least one week to thoroughly evacuate their cities and shelter refugees against radioactive fallout, war-related casualties could be reduced to the "low tens of millions, about half of which would be fatalities." Some analysts have gone so far as to term these fatality levels "acceptable" in view of the fact that the U.S.S.R. suffered 20 million dead in World War II. Even if evacuation could reduce the number of prompt fatalities, however, the degree of damage the U.S. could inflict on the unprotectable economic resources of the U.S.S.R. would be so great that the U.S.S.R. would be eliminated as a major industrial power.



RELATIVE CONCENTRATIONS of potential population targets and military targets in the U.S. and the U.S.S.R. are suggested by these two maps. The black dots indicate the location of the largest cities in each country. The colored symbols designate strategic-weapons instal-

One purpose of any campaign of strategic bombardment is to reduce an enemy's potential for supporting armed forces in the field. In World War II factories, transportation systems and power plants were attacked. One goal of such bombing campaigns was to destroy industries on which other economic sectors relied, depriving those sectors of essential inputs and leading to an expanding industrial incapacitation. The bombing of Germany failed to have this effect, in part because of limitations on the size of chemical-explosive payloads. Attacks on a given target system had to be spread out over many raids, and so the surviving facilities could be "jury-rigged" to compensate for the damage done to certain parts of the industrial network. Civilians left homeless in attacks could be housed in nearby towns that had not been damaged. Even after the atomic bombing of Hiroshima and Nagasaki enough aid was available in surrounding communities to significantly aid the survivors.

The deployment of large numbers of nuclear weapons has radically changed the context of strategic bombing. The forces currently deployed by the U.S. and the U.S.S.R. are able to destroy the entire industrial structure of any nation. Moreover, this damage can be done all at once, so that little assistance would be available for those targets that had come under attack.

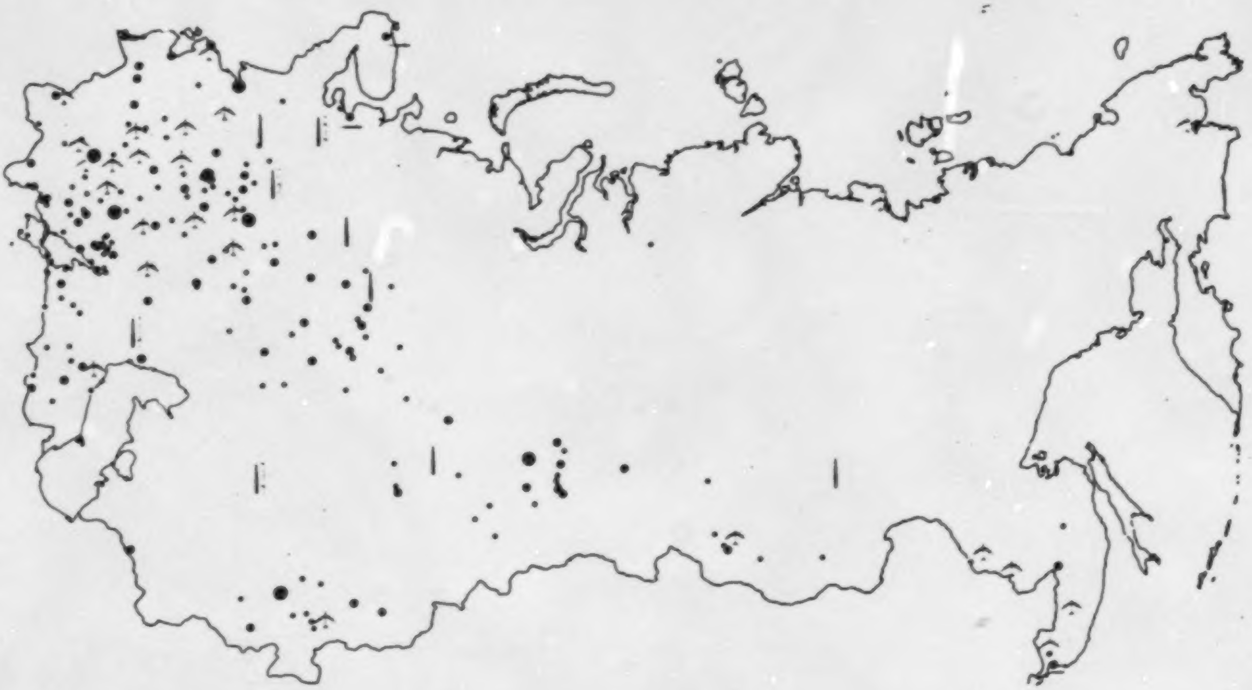
In both the U.S. and the U.S.S.R. a limited number of facilities comprise the bulk of the productive capacity in many major industries. The centrally planned economy of the U.S.S.R. in particular has many vulnerable bottlenecks and choke points. Hence the destruction of a single target or very few targets could disrupt production in many other industries. Because of this concentration 100 equivalent megatons, corresponding to the payload of the missiles carried by five or six Poseidon submarines, would be sufficient to destroy crucial industries without which the Russian economy could not sustain itself.

For example, a study conducted recently by the Office of Technology Assessment of Congress showed that a U.S. attack on petroleum refineries in the U.S.S.R. could, with only some 40 low-yield nuclear warheads, destroy about three-fourths of the U.S.S.R.'s entire refining capacity. Comparatively few warheads could also destroy the transportation, energy, maintenance and management resources needed for any postwar economic recovery. The Russian energy system is particularly vulnerable to attack and is crucial for recovery. For instance, nearly all the intercity freight in the U.S.S.R. is shipped over electrified rail networks, whereas much of it in the U.S. goes by truck.

These kinds of figures should not be taken as evidence that the U.S. economy is somehow less vulnerable than that of the U.S.S.R. The Russians have more than enough warheads to cover similar U.S. targets. Rather, it is instructive to remember, as the CIA report noted, that "the coordination of requirements with available supplies and transportation is a complex problem for Soviet planners even in peacetime, let alone following a large-scale nuclear attack on the U.S.S.R."

Even if the Russian evacuation plans were successful, they would only defer, not prevent, the impact of the war on civilians. A nation's fixed medical, technical and educational base would, after all, be destroyed in a nuclear war. Recovery stockpiles and facilities could also be targeted. If some food, pharmaceuticals, clothing, equipment and spare parts did survive, there would be neither the administrative structure to allocate the goods nor the transport to ship them where they were needed. The destruction of refineries and electric-power stations could interdict resupply, and shortages could develop quickly. Perishable goods, including many foods and drugs, would be lost if electric power were cut off. The devastation of housing would make summer life difficult and winter existence intolerable. This would be particularly true in the U.S.S.R., where outside cities there are few alternative forms of shelter such as hotels. In short, civil defense might protect some people, but it could not prevent the widespread destruction of property essential to the support of life. The economic interdependence of an industrialized nation is a vulnerability that cannot be defended.

A nation's administrative and social structure would also be disrupted by nu-



lations: major airfields, missile-submarine bases, land-based-missile launching sites and missile-testing sites (*see key at bottom left*). In addition to the installations shown here the U.S. has a variety of strategic forces stationed elsewhere in the world (mainly on the island of Guam and in Alaska). In general suitable targets for nuclear attack are more concentrated in the U.S.S.R. than they are in the U.S.

clear attack to the point that a political system might be shattered beyond reconstitution. Although special bunkers are being constructed to protect the bureaucratic and internal-security apparatus of the Soviet government in the event of war, the U.S. does not lack the means to attack those shelters.

The delayed effects of a nuclear war between the U.S. and the U.S.S.R. would propagate far beyond the borders of the antagonists and their allies. Worldwide effects would result mainly from the fact that the stem and cloud of most nuclear explosions would penetrate the stratosphere and deposit several kinds of radioactive material in it. Unlike the lower part of the atmosphere, the stratosphere lacks the moisture and shear motions needed to quickly sort out particulate and gaseous matter. Since such materials would remain in the stratosphere for a long time, their effects would be diluted. One consequence of this long residence time, however, would be wide dispersion. Thus although stratospheric effects would be less intense than lower-atmospheric ones, they would last longer and be more widespread.

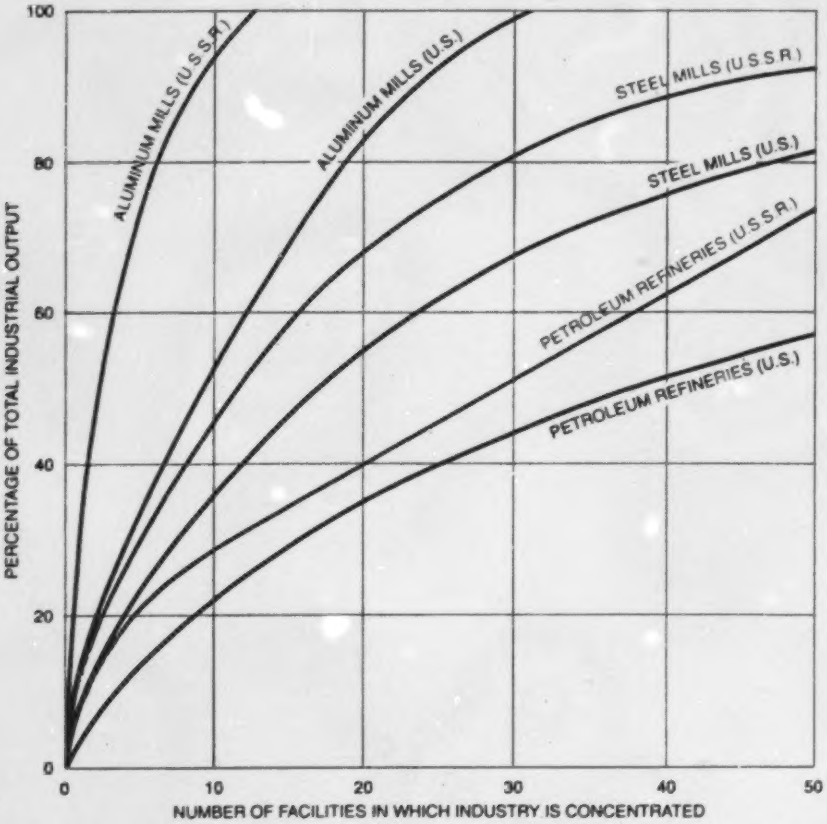
A report issued by the National Academy of Sciences in 1975 listed three effects of nuclear war that might have adverse worldwide impacts. First, stratospheric ozone might be depleted, because nitrogen oxides made from atmospheric nitrogen and oxygen by the heat of nuclear explosions would be injected into the stratosphere, where they would aid in the conversion of ozone into molecular oxygen. Second, the deposition of large amounts of dust in the upper atmosphere could alter the amount of solar radiation arriving at the earth's surface. Third, hazardous radioactive isotopes could be dispersed through the stratosphere, falling out slowly on a worldwide scale.

Stratospheric ozone plays an important role in life on the earth by screening out harmful ultraviolet radiation. The NAS report estimated that a 10,000-megaton nuclear war could destroy half of the ozone in the Northern Hemisphere and about 30 percent of the ozone in the Southern Hemisphere. As opponents of the supersonic transport aircraft and fluorocarbon spray-can propellants have contended, the depletion of the ozone layer could lead to a variety of medical and environmental problems. Higher cancer rates and harmful effects on plants, including crop plants, could result. The destruction of stratospheric ozone on this scale could upset the thermal structure of the upper atmosphere and lead to worldwide temperature changes. After such a war ozone levels might not return to normal levels for many years.

A single one-megaton surface burst would also project thousands of tons of fine dust into the stratosphere. The dust could absorb, reflect and scatter radiation arriving from the sun or reflected from the earth, and there have been suggestions that this effect could lead to a change in the weather at the earth's surface. According to the NAS study, however, a 10,000-megaton war would inject no more dust into the stratosphere than was thrown up by the explosion of the volcano Krakatoa in 1883. By extrapolating from such volcanic events the NAS report concluded that only a slight change in surface weather conditions might result.

Radioactive isotopes would be distributed worldwide by stratospheric transport processes. Since these isotopes would have a relatively long residence time in the stratosphere, many of the dangerous short-lived ones would decay before they could reach the ground. Nevertheless, some hazardous isotopes, such as strontium 90, cesium 137, iodine 131 and carbon 14, would persist and might enter the food chains of the biosphere. The NAS report did not suggest that this fallout would have the kind of worldwide lethal consequences for human life that are depicted in novels such as Nevil Shute's *On the Beach*. Regional concentrations of fallout in the combatant nations (and neighboring nations) could nonetheless present an acute radiation hazard to many evacuees and rural residents who might not have been directly imperiled during an attack on cities. Less intense "hot spots" could appear at greater distances, with adverse biological consequences. Few parts of the attacked country would escape the threat of fallout, since a thorough attack would cover economic and military targets nationwide, leaving most areas contaminated.

Atmospheric phenomena are complex, and it is not clear how a 10,000-megaton nuclear war might influence climate. Although the NAS study estimated that the effects of ozone depletion and dust loading probably would not have an irreversible impact on global weather patterns, the report did indicate that changes of a much more serious nature could not be excluded. The possibility of synergistic actions among these various effects cannot be ignored. For example, it has been noted that a global cooling of only one degree C. could eliminate all wheat growing in Canada.



KEY INDUSTRIAL TARGETS are also more concentrated in the U.S.S.R. than they are in the U.S., as these three pairs of curves demonstrate. As a consequence fewer nuclear warheads would be needed to cripple the U.S.S.R.'s production of such vital materials as steel, petroleum and nonferrous metals. In addition the economies of both countries are characterized by crucial bottlenecks. For example, only one plant at Pavlodar in the U.S.S.R. does work essential to 65 percent of the aluminum industry of the country. By the same token close to 80 percent of the iron ore shipped in the U.S. travels through one set of locks at Sault Sainte Marie.

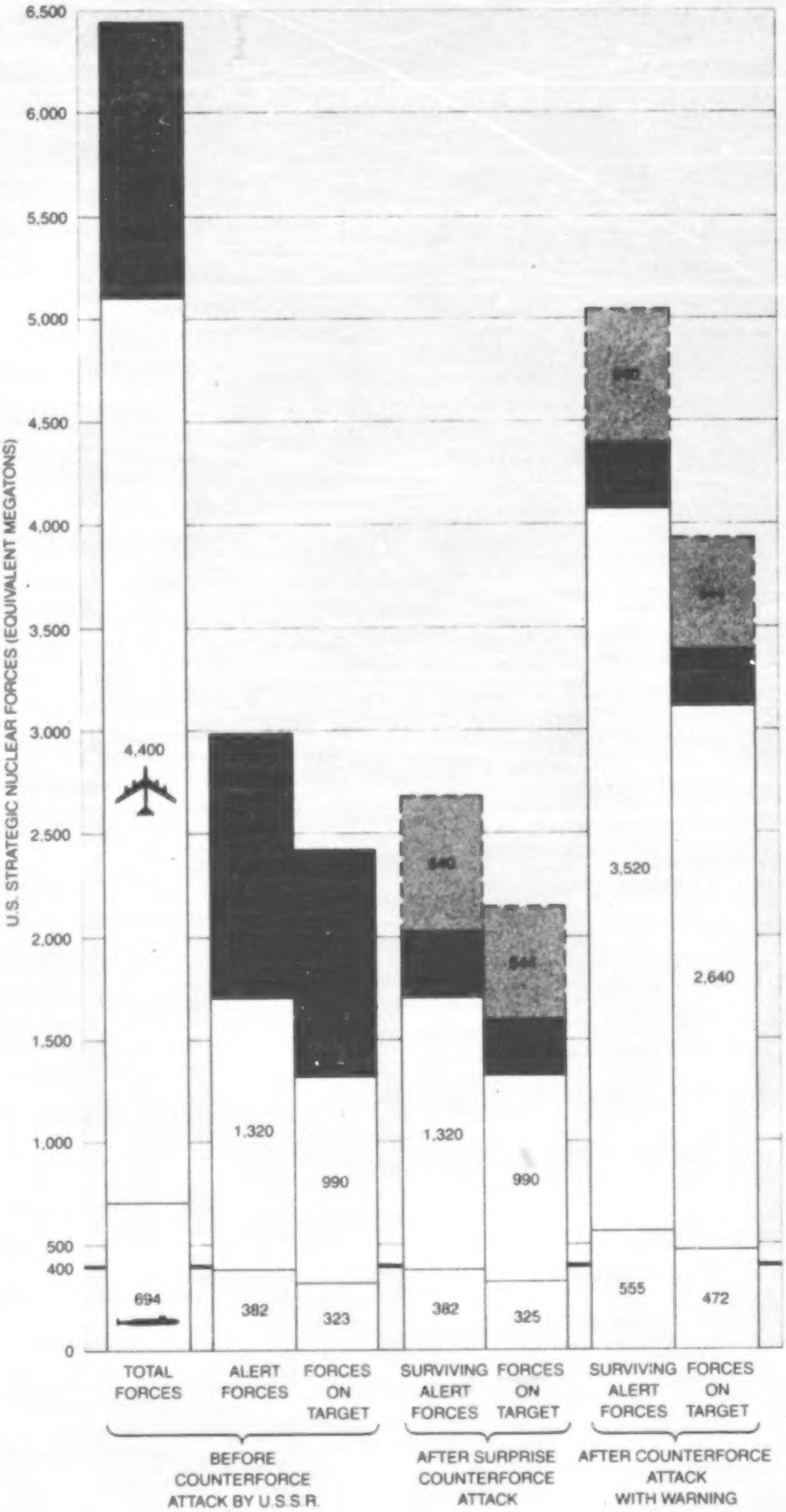
Direr possibilities include the expansion or melting of polar ice.

The NAS report did not examine possible changes in continental weather resulting from effects such as fires. A single 10-megaton airburst could ignite a forest fire covering thousands of square miles. The burning of the broad grasslands and forests of the U.S. and the U.S.S.R. could defoliate the natural ground cover, thereby changing the reflectivity of the earth's surface and giving rise to weather changes. Particulate combustion products thrown into the atmosphere by forest fires would absorb and reflect solar radiation, and they would also act as nucleation centers for the formation of water droplets and ice crystals, thereby increasing the cloud cover and altering the distribution of precipitation. Such local effects could exacerbate the worldwide phenomena cited above.

Finally, just as the various components of a national economy are interlocked, so nations themselves are interdependent. The destruction of the economies of the major powers by a nuclear war would be a massive blow to the economies of nations dependent on those powers for the exchange of commodities and technology. The less developed countries in particular would suffer, since at this stage of their development they need to import technology from more developed countries.

In sum, the cumulative effects of an all-out nuclear war would be so catastrophic that they render any notion of "victory" meaningless. The formal methodologies of the assured-destruction scenarios do not reveal the full extent of these effects. Moreover, arguments that throw doubt on the sufficiency of the deterrent capability of the U.S. exclude some of the most profound and long-lasting of these effects. When the delayed effects of all-out war are taken into consideration, it should become clear that no countermeasure would significantly lessen the degree of devastation that would surely occur. Even if a highly efficient program for the evacuation of cities could substantially reduce prompt fatalities, it could not prevent the delayed social consequences of industrial and economic devastation. The magnitude of either the prompt disaster or the delayed one would be so great that neither disaster could ever be considered tolerable.

There are many steps that could be taken by both sides to diminish the likelihood of an all-out nuclear war. Many of them are now the subject of strong disagreement. One step in the right direction would be to reframe the currently misleading concept of assured destruction in more realistic terms to reflect the full extent of the catastrophe that would be represented by a nuclear war.



U.S. STRATEGIC ARSENAL would retain far more deliverable nuclear weapons than would be necessary to accomplish the assured-destruction mission, even after an all-out surprise attack by the U.S.S.R. on strategic military targets in the U.S. If there were any warning available before such an attack, the number of U.S. nuclear weapons that could be delivered on targets in the U.S.S.R. would increase considerably. The heavy black line across the bottom of the chart indicates the 400 equivalent megatons thought to be sufficient to kill 35 percent of the people in the U.S.S.R. Strategic forces above this level are referred to as overkill capability.

APPENDIX 5

TEACHER'S GLOSSARY

A-BOMB	An atomic or fission weapon (see FISSION).
ANTIBALLISTIC MISSILE	Any missile designed to destroy a ballistic missile or its warhead.
ATOM	The smallest part of an element that still retains the characteristics of that element.
BALLISTIC MISSILE	A missile, classified by range, that consists of a booster rocket and a warhead that arcs to its target.
BILATERAL TREATY	Used to refer to treaties that have reciprocal effects on two sides or parties.
BLAST WAVE	A pulse of air from an explosion, in which the pressure increases sharply at the front, accompanied by high winds.
BOMB	A weapon without propulsion that is dropped from any sort of aircraft.
BOMBER	An aircraft, usually classified by range, capable of delivering nuclear and nonnuclear bombs. Long-range bombers can travel 6,000 or more miles without refueling.
CIRCULAR ERROR PROBABLE	A measure of missile accuracy, the CEP is the radius of a circle around a target in which 50 percent of the missiles aimed at the target will land.
CIVIL DEFENSE	The protection of a country's general population, national leadership, and industry from nuclear attack through "passive" means.
COUNTERFORCE	The ability to strike an enemy's military targets, including bomber and ballistic submarine bases and hardened missile silos.
COUNTERVALUE	The ability to strike an enemy's nonmilitary targets such as population centers, industrial facilities, and natural resources.
CRITICAL MASS	The minimum mass of fissionable material that will maintain a fission reaction.
CRUISE MISSILE	A remote-control missile that flies along the contours of the ground to its target. It can be launched on land, at sea, or in the air.
DEPLOYMENT	Distribution of a weapon system to units for use in combat—the final stage in the weapons-acquisition process.
DETERRENCE	A strategy designed to dissuade an enemy from attack, often by threatening unacceptable retaliation.
DOCTRINE	A statement of fundamental government policy.
ELEMENT	One of the distinct, basic varieties of matter occurring in nature which, individually or in combination, compose substances of all kinds. Approximately 90 different elements are known to exist in nature and several others, including plutonium, have been obtained as a result of nuclear reactions with these elements.

ESCALATION	Increasing intensity, extent, or scope. Often used to refer to the tendency of combatants to respond to an opponent's actions with increased violence or the use of more sophisticated weapons.
ESSENTIAL EQUIVALENCE	A balance of forces in which the capabilities of both parties are approximately equal in effectiveness, though they might not be equal numerically.
FALLOUT	The radioactive particles spread by nuclear blasts which are carried into the atmosphere and returned to earth, often in rain.
FIRE-STORM	Stationary mass fire, generally in built-up urban areas, causing strong, inrushing winds from all sides. The winds keep the fires from spreading while adding fresh oxygen to increase their intensity.
FIRST STRIKE	The initial use of nuclear weapons against an enemy. The term is generally used to refer to a "preemptive" nuclear attack against bomber bases, submarine bases, and missile silos.
FIRST USE	A term used to refer to the first use of nuclear weapons in a conflict.
FISSION	The process of splitting atomic nuclei through bombardment by neutrons. This process yields vast quantities of energy as well as more neutrons capable of initiating further fission.
FLEXIBLE RESPONSE	The capacity to meet aggression or deal with conflict by choosing among a variety of options.
FUSION	The process of combining atomic nuclei to form a single, heavier element or nucleus, which releases substantial amounts of energy.
GENETIC EFFECT	The effect of various agents (including nuclear radiation) in producing changes in genes. A mutant or changed gene causes changes in the next generation which may or may not be apparent.
GROUND ZERO	The point of the earth's surface directly on or above which a nuclear weapon detonates.
H-BOMB	A nuclear weapon in which part of the explosive energy is obtained from nuclear fusion reactions. (see FUSION)
HARD OR HARDENED TARGET	A strategic target protected against the effects of nuclear weapons, usually accomplished by reinforcement with concrete and earth.
INTERCONTINENTAL BALLISTIC MISSILE (ICBM)	A ballistic missile with a range of 4,000 miles or more. Modern ICBMs have a range of up to 9,000 miles and need about 30 minutes to reach their targets.
ISOTOPES	Forms of the same element having identical chemical properties but differing in their atomic masses and their nuclear properties.
KILOTON (KT)	Explosive force equivalent to one thousand tons of TNT. The Hiroshima bomb was approximately 13 KT.
LAUNCH ON WARNING	A strategic doctrine under which bombers and land-based missiles would be launched on receipt of warning (from satellites and other early-warning systems) that an opponent has launched its missiles.
LIMITED NUCLEAR WAR	A doctrine that assumes "full-scale" nuclear exchanges can be avoided by targeting military and industrial centers, rather than cities. Some analysts think this might limit the scope and damage of nuclear war.

MEGATON (MT)	Explosive force equivalent to one million tons of TNT.
MULTIPLE INDEPENDENTLY TARGETABLE REENTRY VEHICLE (MIRV)	A missile carrying two or more warheads, each of which can be guided to a separate target.
MUTUAL ASSURED DESTRUCTION (MAD)	The concept that either the U.S. or the USSR could sustain a nuclear attack and still inflict unacceptable damage on the other.
NATIONAL TECHNICAL MEANS	A method of verifying compliance with negotiated arms control agreements generally consistent with the recognized provisions of international law, commonly understood as surveillance by satellite and aerial reconnaissance.
NEGOTIATE	To arrange for or bring about through conference, discussion, and compromise.
NUCLEAR WAR	A war involving the use of nuclear weapons.
NUCLEAR WEAPON	A general name given to any weapon in which the explosion results from the energy released by reactions involving the fission and/or fusion of atomic nuclei.
NUCLEUS	The small, central, positively charged region of an atom which carries essentially all the mass.
POUNDS PER SQUARE INCH (PSI)	A measure of nuclear blast overpressure used to calculate the effects of a nuclear detonation or the ability of a structure to withstand a nuclear blast.
PROLIFERATION	The spread of weapons, usually referring to nuclear weapons. Horizontal proliferation refers to the acquisition of nuclear weapons by nations that previously had none. Vertical proliferation refers to increases in a nuclear nation's arsenal.
SECOND STRIKE	A retaliatory attack after an opponent's first strike. Second-strike capability describes the capacity to attack after suffering a first strike. U.S. deterrent strategy is based on high confidence in this capability.
STRATEGIC WEAPONS	Those weapons capable of directly affecting another nation's war-fighting capability (see TACTICAL NUCLEAR WEAPONS and THEATER NUCLEAR WEAPONS).
SUBMARINE LAUNCHED BALLISTIC MISSILE (SLBM)	Any ballistic missile launched from a submarine.
TACTICAL NUCLEAR WEAPONS	Designed for use on a battlefield in combat with opposing forces.
THEATER NUCLEAR WEAPON	A nuclear weapon of long range and high yield designed to strike an enemy target within a specific geographical region.
THROW-WEIGHT	The maximum weight of the warheads, guidance unit, and penetration aids which can be delivered by a missile over a particular range and in a stated trajectory.
TREATY	An agreement reached through negotiation. This usually refers to a formal arrangement, authorized and ratified by the governments involved.
TRIAD	A strategic force composed of land-based ICBMs, submarine-launched ballistic missiles, and long-range bombers.
VERIFICATION	The process of determining through means of inspection of intelligence gathering whether an opponent is complying with arms control agreements.

WARHEAD	The part of a missile, torpedo, rocket, or other weapon that contains the nuclear or other explosive system.
WEAPONS EFFECTS	Blast, shock, and short- and long-term radiation resulting from use of nuclear weapons.
YIELD	The force of a nuclear explosion expressed as an equivalent of energy produced by tons of TNT.

Many of the above definitions were compiled or adapted from the following:

The Effects of Nuclear Weapons (GPO, 1977).
A Glossary of Arms Control Terms (Arms Control Association, 1979).
Glossary (San Francisco: Public Media Center).

APPENDIX 6

STUDENTS' GLOSSARY

Lesson 1

CONFLICT	A struggle between opposing forces.
HIBAKUSHA	(hē-bä′-ka-shä) Japanese word for survivor.
WEAPON	An implement of fighting or warfare; two subgroups are bombs and missiles.
BOMB	An explosive device that is usually dropped on a target from a plane.
MISSILE	A weapon that has its own engine or means or propulsion.
NUCLEAR WEAPON	One that gets its main source of increased power from the nucleus of an atom.
MEGATON	Explosive force equal to 1 million tons of TNT.
KILOTON	Explosive force equal to 1,000 tons of TNT (Hiroshima bomb was approximately 13 kilotons).

Lesson 2

ESCALATION	The process of increasing; the increasing spiral of violence of a conflict.
RESOLUTION	The act of reducing to a simpler form; in problem solving—breaking the problem down to find a simple solution.

Lesson 3

COMMUNICATION	The transmission or exchange of ideas, information, etc., between places or persons through speech or writing.
NEGOTIATION	The act of bargaining or conferring with another party or parties with the aim of reaching an agreement.
COMPROMISE	A settlement by mutual concession where both parties surrender or give up some claims, purposes, or principles.

Lesson 4

A-BOMB	An atomic or fission weapon.
H-BOMB	A nuclear weapon in which part of the explosive energy is obtained from nuclear fusion reactions.
FISSION	The process of *splitting* of atomic nuclei to create vast amounts of energy.
FUSION	The process of *combining* atomic nuclei to form a single heavier nucleus, which releases substantial amounts of energy.
GROUND ZERO	The point on the earth's surface directly on or above which a nuclear weapon is detonated (explodes).

Lessons 5-6

RADIATION SICKNESS	A diseased condition due to the body's absorption of excess radiation and marked by fatigue, nausea, internal bleeding, and progressive tissue breakdown.
FALLOUT	The radioactive particles spread by nuclear blasts, which are formed when dirt is taken into the mushroom cloud. These particles later return to earth, often in snow or rain.
PROLIFERATION	The spread of weapons, usually referring to the acquisition of nuclear weapons by nations that previously had none.

Lesson 7

WARHEAD	The part of a missile, torpedo, rocket, or other weapon that contains the nuclear or other explosive system.
BALLISTIC MISSILE	A missile that consists of a booster rocket and a warhead that arcs to its target.
INTERCONTINENTAL BALLISTIC MISSILE (ICBM)	A ballistic missile with a range of 4,000 miles or more. Modern ICBMs range up to 9,000 miles and need about 30 minutes to reach their targets.
ANTIBALLISTIC MISSILE	Any missile designed to destroy a ballistic missile or its warhead.
LIMITED NUCLEAR WAR	A doctrine that assumes "full-scale" nuclear exchanges can be avoided by targeting military and industrial centers, rather than cities. Some analysts think this might limit the scope and damage of nuclear war.

Lessons 8-9

FACT	Something known and proven as certain.
OPINION	A belief based on knowledge, but not proven.
PROPAGANDA	All words and actions that express an opinion in the form of fact.
RELATIONSHIP	The state of being related or connected; suggests mutual regard and affection.
IDEAL	A standard of supreme perfection, representing the best of its kind.

APPENDIX 7

TEACHER COMMENTS

After completing *Choices*, teachers are invited to respond to the following survey and to mail the results to Robert McClure, NEA/IPD, 1201 16th Street, NW, Washington, DC 20036.

Name: ______________________________

Address: ______________________________

______________________ Phone: ______________________

Grade level and subject: ______________________________

Overall effectiveness: To what extent did *Choices* achieve its purpose of introducing students to—and involving them in—the issues of conflict and nuclear war? (Circle one number on the scale below.)

Not at all ______________________ Completely
1 2 3 4 5

Effectiveness of lessons: To what extent did the lessons achieve their stated purposes?

Lesson	Not at all				Completely
1	1	2	3	4	5
Lesson	Not at all				Completely
2	1	2	3	4	5
Lesson	Not at all				Completely
3	1	2	3	4	5
Lesson	Not at all				Completely
4	1	2	3	4	5
Lesson	Not at all				Completely
5	1	2	3	4	5
Lesson	Not at all				Completely
6	1	2	3	4	5
Lesson	Not at all				Completely
7	1	2	3	4	5
Lesson	Not at all				Completely
8	1	2	3	4	5
Lesson	Not at all				Completely
9	1	2	3	4	5
Lesson	Not at all				Completely
10	1	2	3	4	5

Effectiveness of activities: Which activities contributed significantly to the effectiveness of the lessons, and which were unsuccessful? Please comment on those that were unsuccessful—and on anything else you think would be helpful in improving *Choices.* Use extra sheets, if necessary.

APPENDIX 8

STUDENT COMMENTS

To the teacher: The survey below may be completed by students after they finish *Choices.* It is, of course, optional. In addition, the authors would be interested in any student comments in whatever form you would care to collect them. Please forward comments to Robert McClure, NEA/IPD, 1201 16th Street, NW, Washington, DC 20036.

Name: ______________________________ Grade: __________

School: ____________________ Teacher: ____________________

School address: ______________________________

Did you find learning about conflict and nuclear war interesting? Why? __________

What activities did you especially like? (The M&Ms game? Keeping a journal? Other?)

Was there anything you did not like?

Can you think of anything—more information, other games, or something else—that students your age might like included in *Choices?*

Do you plan to learn more about conflict and/or nuclear war? How? (By doing your own reading? By talking to people who know about the subjects? Other?) What more would you like to learn?

What do you think was the most important thing you learned from *Choices?*

The people who wrote *Choices* would be interested in anything you would like to say to them about what you have just studied—how to make it better, or just your personal thoughts. Use more paper, if you need it. And thank you.

APPENDIX 9

SAMPLE LETTER TO PARENTS

After securing permission from the school administration to teach *Chocies*, some teachers will wish to contact parents before beginning the unit. The sample letter below may prove useful as a model.

Dear Parent/Guardian:

In the coming weeks, I will be teaching *Choices: A Unit on Conflict and Nuclear War* to my students at ______________________ School. This has received the approval and support of the school administration.

We believe that students in the__________ grade have little, if any, understanding of nuclear weapons and nuclear war. Yet these issues are among the most important facing the world today. By teaching the unit, I hope to help your child learn some basic facts and discuss issues of the nuclear age. Together we will consider nuclear weapons, their history and danger, and the need to prevent nuclear war. We will also be talking about conflict between people, and how it relates to conflict between nations.

Choices was developed by the Union of Concerned Scientists in cooperation with the Massachusetts Teachers Association and the National Education Association. It was field-tested in the fall of 1982 in 34 states.

During the unit, your son/daughter will probably want to discuss with you many of the issues we study in class. I would appreciate anything you could do at home to encourage such discussion. One class activity involves an opinion survey on nuclear issues, which students will ask their parents to complete.

If you have any questions about *Choices*, please do not hesitate to contact me at school, (phone number), between the hours of ________ and________. If you can call only at another time, please leave with the secretary your phone number and a time that would be convenient for me to call you.

Thank you for your cooperation.

Sincerely,